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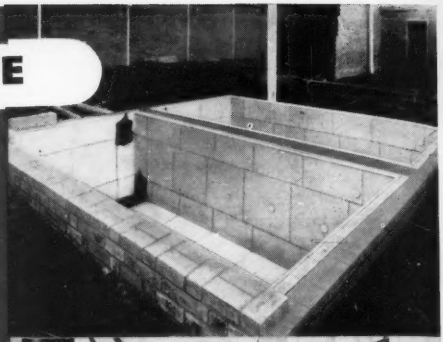

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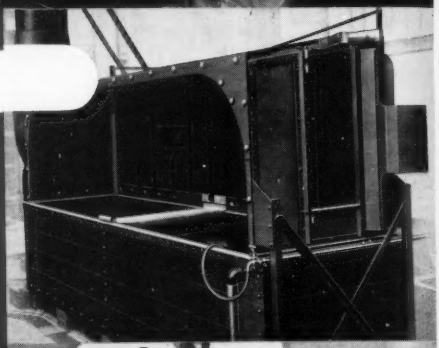

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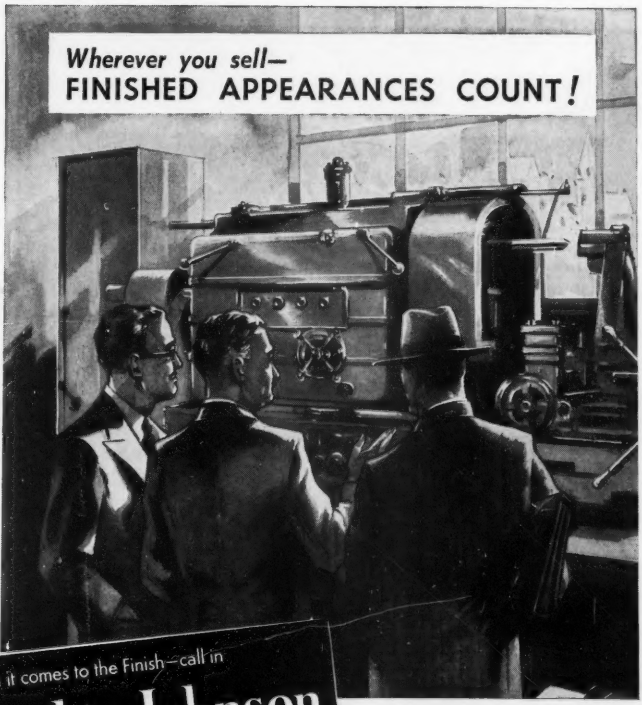

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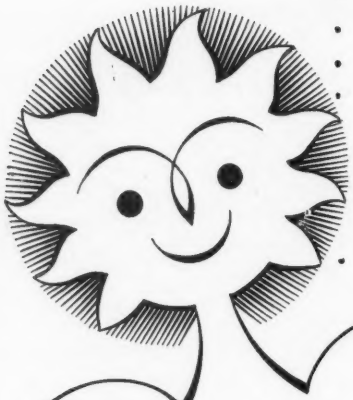

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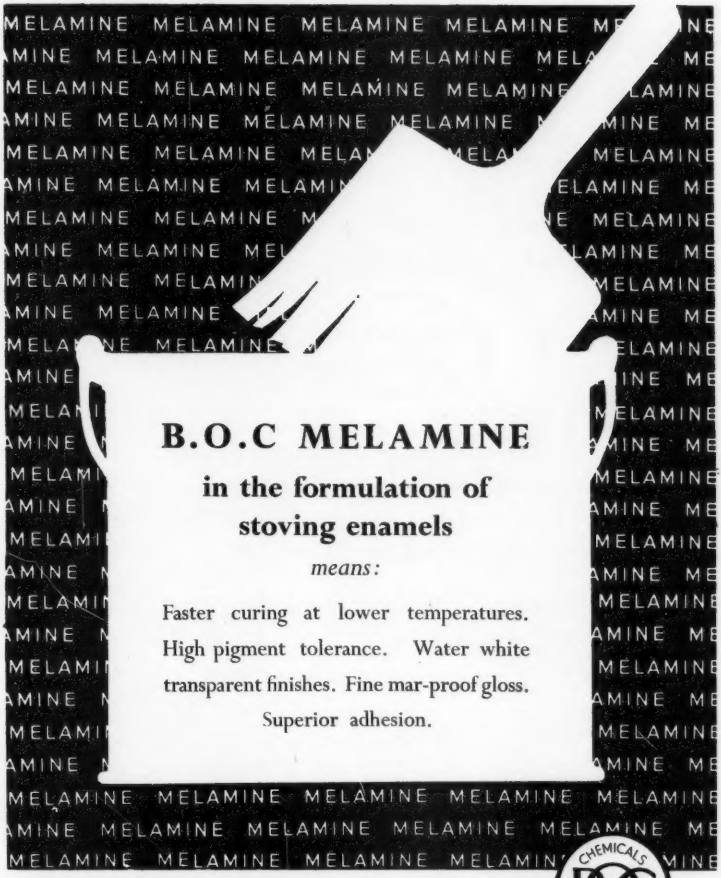

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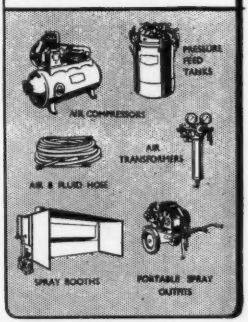

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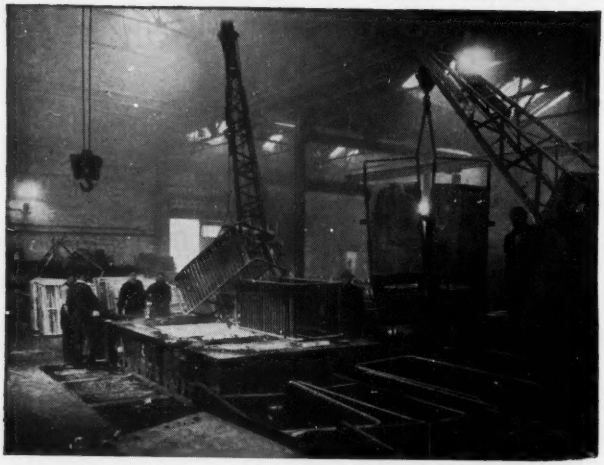

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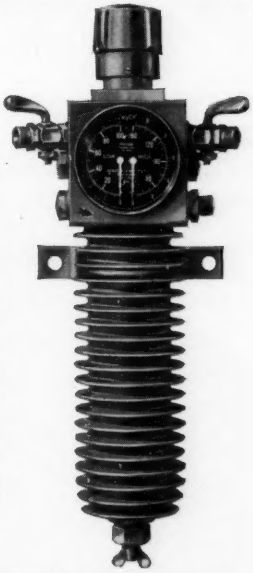

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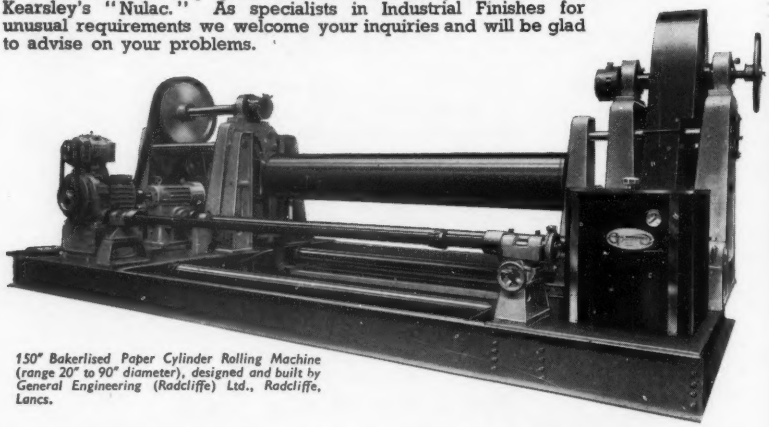

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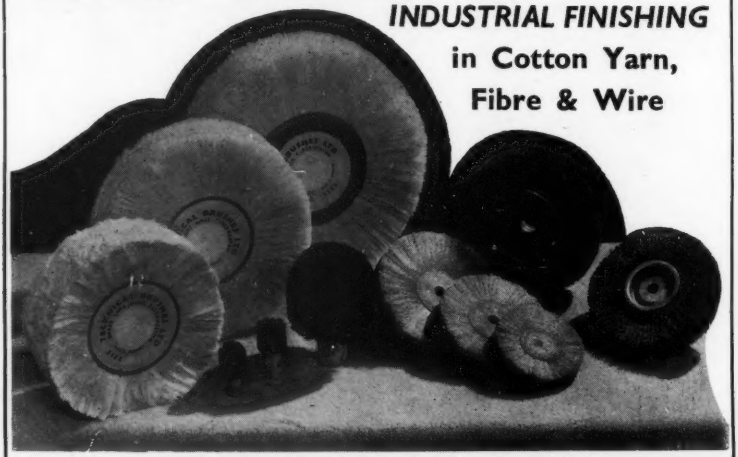

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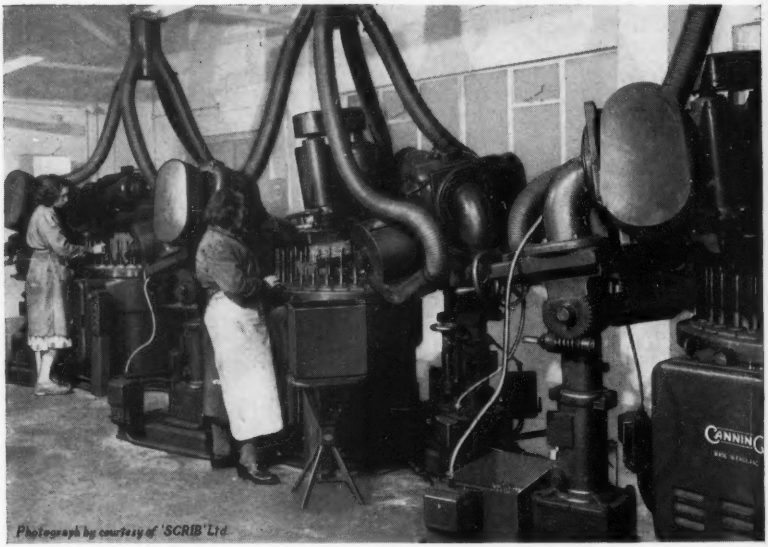

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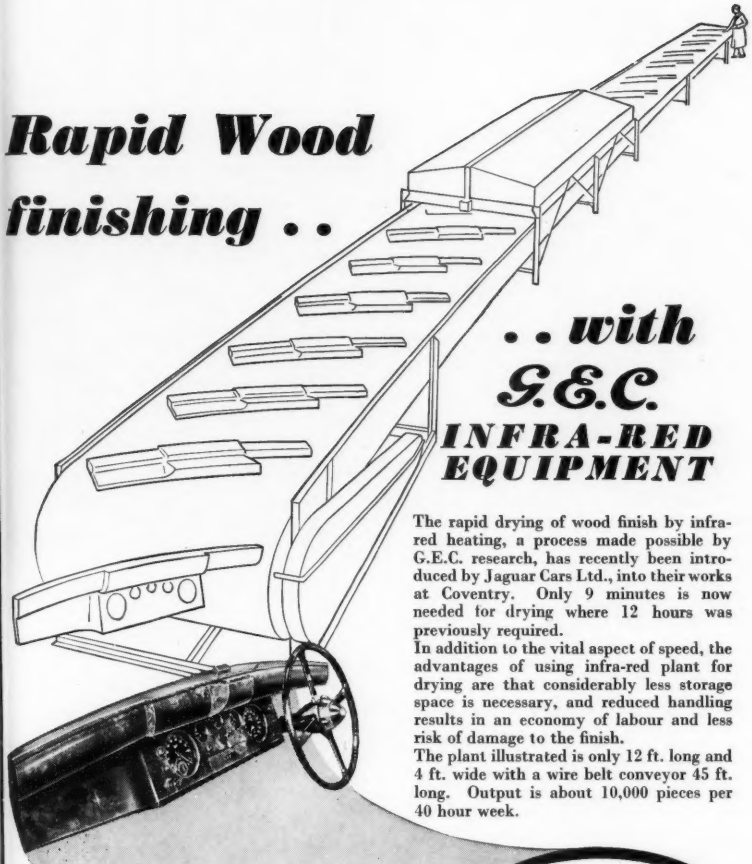

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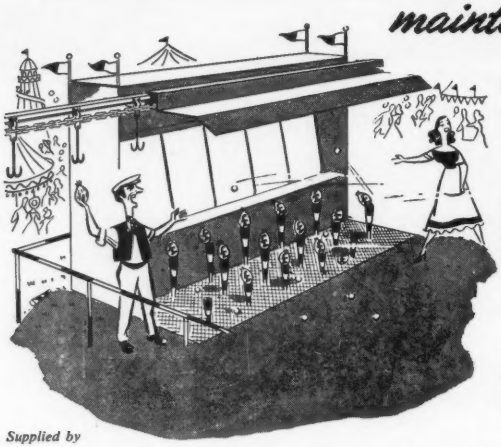

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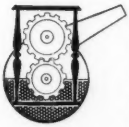

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OCTOBER 1952

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Industrial Finishing

VOL. 5 OCTOBER, 1952 NO. 52

TRAINING THE PAINTER

by ARGUS

THE report of the annual conference at Harrogate on the 3rd and 4th May, 1952, on behalf of the Association of Painting Craft Teachers, has been published. On this occasion the hosts to the conference were Imperial Chemical Industries Ltd.—the Paints Division—and among those other paint manufacturers represented were included Lewis Berger (Gt. Britain) Ltd., Walpamur Ltd., and Paramount Paints Ltd. Broadly speaking, the teachers themselves wanted better facilities; the paint suppliers wanted better application of their materials; the painting contractors wanted better quality entrants to their industry, and the employees' representatives wanted better conditions.

Frankly, the common point in all these "vested" interests devolves upon the man who actually has to apply the paint.

Welfare Side Needs Attention.

The organising secretary for the London district of the National Society of Painters agreed that there were not enough apprentices coming into the trade. He accused employers of discouraging young people by making them do the rough preparation work. Of course, as nine painters out of ten will agree, 90 per cent. of the "art" of painting revolves around the arduous task of cleaning and preparing the surface. There is no short cut to this. It is just a glorified chore, which is obnoxious, unhygienic and exposes the worker to conditions which are the very antithesis of personal hygiene which are being stressed today at school. There is no doubt that contractors often use the "cheap" labour of apprentices to do the rough cleaning-down jobs, after which the relatively highly-paid craftsman wields his brush. It was pointed out by the speaker that foremen undo much of the training given to their apprentices in schools. He pointed out the casual nature of the work, stating that when the conference was being held there were 3,000 painters out of work in the London area alone. He stressed that the welfare side of the industry needed attention.

Of course it does! Paint is manufactured today under relatively hygienic conditions; the old varnish kitchen is becoming a thing of the past because operatives refuse to breath continuously the stench breathed by their fathers and grandfathers. Again, teachers impart their

instruction in relatively airy and well-lit buildings secure from the rigours of the atmosphere. But the painter has to work completely exposed to the most appalling conditions. On structural steel work, such as painting a gas holder, it is not a question of any art or craft, but sheer drudgery, and it is not surprising that many men refuse this kind of work.

Out of Date

As much painting is practised today it is the height of absurdity to call it a craft. It is nothing more or less than unskilled or semi-skilled labour under appalling conditions. You place a man in a bo'sun's chair on a bridge or outside a factory—or you ask him to clean down the outside of a house, scraping with more or less a knife-blade. In terms of modern application methods this structural painting is as antediluvian as Methuselah in person.

It costs practically three times as much to prepare and apply the paint as the cost of the paint itself. The result is that a painting job is prohibitive not only to the householder, but even to a factory itself. Attempts are made to save on the paint, and regretfully it must be confessed that many people who ought to know better, such as Housing Committees to Local Authorities, still buy paint on the lowest tender. Regretfully it must be confessed that some paint manufacturers pander to this foolishness by the obvious ways open to, and well known by, the paint technologist.

Expensive Equipment

Paint is applied by painting contractors, often in a small way of business. They view with alarm the necessity of buying expensive equipment to shorten the period of preparation. Viewing the thing from a common sense basis, the only way in which the over-all cost of a painting job can be reduced is by the use of economical pretreatment—pneumatically-operated tools can help as well as portable compressors for their operation. But there is a tendency for the painting contractor to shy away from their expense. It is cheaper to use so-called apprentices to do the rough work. The depreciating availability of money is forcing many an amateur to do the job at home for himself. It is sheer humbug for people to talk about the professional painter doing a better job than the amateur. The answer is that the average householder with average common sense, who takes the trouble to read the paint manufacturer's literature, will out-do, in quality, the job done by many of the so-called professionals, who have little interest in the job.

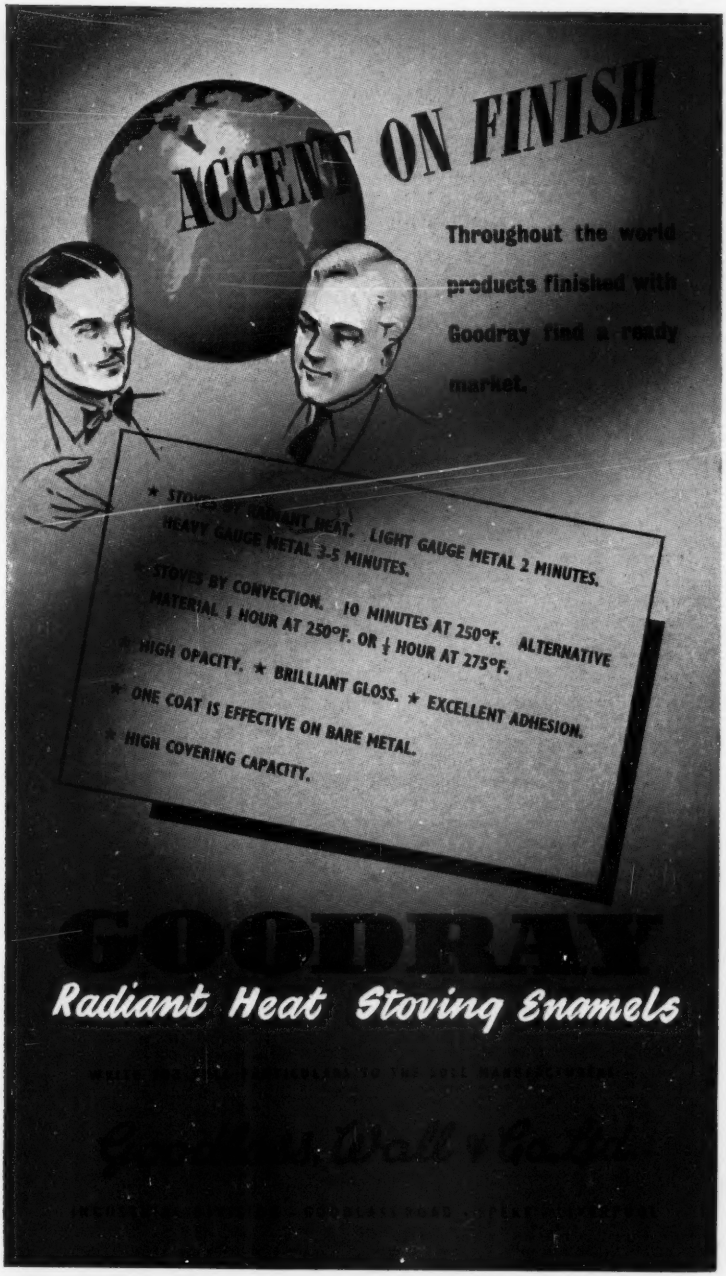
The small painting contractor is often completely at sea in estimating the job. So keen is he to get the business that he cuts and undercuts his rival just to get the job; and having got it, he must make it pay. Whether the paint craftsman is good, bad or indifferent, the sooner he gets on to the job and off again the better it is for the contractor, and I have heard contractors literally complaining to their painters for taking undue time in preparing the surface and for not slapping on the paint quick enough.

As far as exterior painting is concerned, to describe it as a craft is ludicrous.

Interior Work

When it comes to interior work, again there is more care and attention because the operative is not exposed to the atmosphere. But even so, the number of skilled craftsmen left who can do all the operations of the painter of 25 years ago is fast decreasing.

But it is no good bemoaning the fact and thinking that the clock can be turned aback. The village blacksmith was once a craftsman, but he has been replaced by the power press and the power forge. The old fitter and turner could make almost anything on his lathe without even a drawing, but he took time, and at his rate of output the motor-car industry would be reduced to about 1/100th of its present output. The old painter of a bedroom suite did one suite in three or four days. It is a sign of the times, and a wise man views the circumstances and environment in which he finds himself and does his best to conform himself to that environment, rather than kick against it or, more foolishly, try to alter it. We have agreed that the cost of a painting job is 75 per cent.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labour on preparation and application. It is generally agreed that painting is a trade which is attracting labour of a very poor quality. The best teachers in the land cannot perform the miracle of making silk purses out of sows' ears. The best paint in the land will give poor service if applied by poor quality labour.

Fundamentals Overlooked

The problem facing the painting and decorative industry today is one which faced industrial finishing before the war. But on the industrial side the engineer came in, mechanised the process, reduced the arduousness of the task, until the job could be satisfactorily carried out by unskilled or semi-skilled labour. This is the problem confronting the decorative side of the industry. Again it will be the engineer who provides pneumatic machinery which will clean down a job quickly and economically—he has made considerable progress, and it is up to the contractor to employ these means, even if they have to incur capital expense. However, to read the report of the Harrogate Conference this fundamental truth has been overlooked.

One hears in reference to the application of paint by rollers, that the craftsman would not like it! The number of craftsmen left in the painting and decorative industry, if stretched end to end, would hardly reach across Piccadilly Circus. When that cant and humbug is forgotten and it is realised that the only way in which a painting job can be cut in cost is by reducing the cost of application and preparation time, and that the only way in which this can be done is to provide the man on the job with adequate tools for the job, then that tremendous 75 per cent. oncost will be lowered and more people will have their houses painted rather than go to the laborious business of painting them themselves.

Sitting on the Fence

Yet it would appear that at this conference all sat on the fence, all did a modicum of back-scratching, but none would grasp the nettle, because it has a sting. The teacher does not like it because you are telling him that he is wasting his time; the so-called paint craftsman does not like it because you are removing from him his claim to a differential wage; the paint manufacturer is certainly not prepared to offend both; whilst the paint contractor is primarily concerned with getting the job finished as quickly as possible and getting as much as he can for it with the minimum outlay in expenditure for tools and equipment.

There are some painting contractors in the country who have realised this fundamental truth and who are highly mechanised and can do a good job. They prove that if the black magic and the common sense of the engineer is employed, the terrific cost of maintenance and decorating can be cut, for it is therein that the hope of the industry resides.

Property Deterioration

For various reasons the property of Britain is deteriorating. Firstly, the uneconomic rents are a contributory cause, and secondly the tremendously high cost of maintenance plays its part. Undoubtedly one of the means of checking this property deterioration lies in the hands of the painter and decorator. But because many of the controlled rentals do not permit of paying the high cost of repair and decoration, the property is externally and internally disintegrating before our very eyes. The value of this loss per annum amounts to a staggering figure.

To prevent this continued loss is very largely in the hands of the painter and decorator, and he can only do this if he can do his job at a price which is economic to the property owner. In fact, one would go further and add that the painter and decorator can only keep in business if he can fulfil this second demand. It is not a question of craftsmanship—it is a question of bringing themselves up to date and using modern equipment—in short, to quote the Churchillian phrase, he must answer his workers' request "Give us the tools . . ." The old coach-finisher used to produce a wonderful finish with about thirty or forty coats of varnish, each one rubbed down successively, but few could afford to have a coach finished in this manner in this day or age.

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Application of Plastics in Industrial Fabrications, Linings and Coatings

by

V. EVANS, M.Sc., A.R.I.C., A.P.I.

(Special Director and Chief Chemist, Prodorite Limited)

DURING the past few years very considerable development has taken place in the application of plastics in industry; this has been most marked in the chemical industries and other industrial activities where corrosive conditions are found. Although it is undoubtedly true that the present shortages of stainless steel and other corrosion-resistant alloys have helped to bring about this development, the specially valuable and, in some cases unique, properties of many plastics are largely responsible. Even when supplies of special corrosion-resistant alloys are readily available, plastics will still have many applications in these fields, because of their useful properties.

Certain Limitations

There are, of course, important limitations in the application of plastics and it is essential that they are fully understood. The chief limitation is their rather low resistance to heat. Generally speaking, most of the commonly used plastics have temperature limitations in the range 50°-150° C. Certain special materials will withstand higher temperatures, but in all cases careful consideration must be given to the temperatures prevailing in any application. Another limitation is the avoidance of constructions involving plastics as highly stressed load-bearing units. In view of the wide range of different plastic materials available, and the complexity of their properties and behaviour, it cannot be sufficiently emphasised that it is essential to consult the specialist in this field, but it is hoped that this brief account will indicate the possibilities of plastics for these applications.

Another aspect of the use of plastics is cost, and it must be appreciated that as regards their initial cost, they are relatively expensive materials, but generally speaking, no maintenance charges are involved.

Rigid P.V.C.

In the field of fabrication, polymethylmethacrylate (Perspex) has been used for small electro-plating barrels and similar articles, but its use is now being largely replaced by other plastic materials. Foremost amongst these is rigid polyvinylchloride P.V.C. This material is available in sheets of various thickness and to a limited extent as extruded rod and tube. The commercial product varies in colour from light brown to dark reddish brown and has quite good mechanical properties with a tensile strength approaching 8,000 lb. per sq. in. P.V.C. has excellent resistance to acids, alkalies and many solvents, with a temperature limitation of about 50°-60° C. From a constructional viewpoint its great importance arises from the relative ease of fabrication by welding. This welding process is carried out much in the same way as the welding of metals, except that a welding rod of P.V.C. is used, and a hot gas, such as air, is used for heating purposes; special torches have been developed, giving adequate supplies of hot air. By this means quite large and complicated pieces of plant and equipment can be fabricated. Plant such as ventilation stacks, some 22 ft. high

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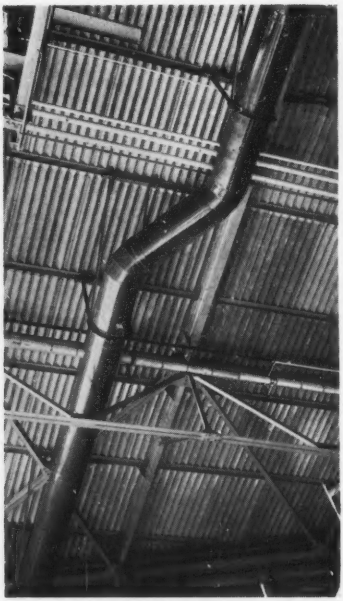


Fume extraction ducting from canopy to roof ventilator, constructed in rigid P.V.C.

and 4 ft. in dia., and absorption towers of similar dimensions has been successfully constructed and proved in practice. Ducting for ventilation and fume extraction has been fabricated in a wide variety of shapes and sizes, some of the installations being really complex. Chemical storage tanks or processing tanks have been constructed entirely in rigid P.V.C., but usually a simple, inexpensive metal frame is used as an external support for such tanks.[1, 2, 3]

Rigid P.V.C. has also been very extensively used in the fabrication of smaller pieces of equipment such as valves, pumps, pump parts, fan impellers and fan cases. Other articles include small tanks, trays, troughs and dishes. Rigid P.V.C. can be successfully extruded and by means of this process it is possible to manufacture tubes and pipes up to a diameter of 6 in.; larger diameters can be formed by bending sheets and welding. P.V.C. pipes can be readily jointed by welding and by using sockets and special adhesives and cements, and this opens up a very wide field in the chemical industry. Owing to the rather large co-efficient of thermal expansion of P.V.C.—some seven times that of mild steel—care is necessary in the design of P.V.C. fabrications, and in the case of pipe lines it is advisable to insert expansion bends at appropriate places.

Polythene

Polythene is another widely used plastic for fabrication of equipment. It has a lower tensile strength than rigid P.V.C., being of the order of 1,500 lb. per sq. in., with remarkable properties of extension. Being much less rigid than P.V.C., most articles made entirely in Polythene are relatively small, but include buckets, jugs, small trays, miniature tanks for experimental work, air agitation coils, metering wheels, storage bottles and vessels and laboratory equipment such as beakers, funnels and baths. Polythene has really excellent chemical resistance to acids, alkalies and many solvents, but, like rigid P.V.C., should not be used at temperatures in excess of about 50° C. Whilst Polythene can be used for the smaller size ducting and ventilation systems, its extrusion to form tubes and pipes up to 12 in. dia. is probably one of the most useful applications.

Like rigid P.V.C., Polythene can be readily welded by means of a Polythene welding rod and a hot gas torch, but in this case an inert gas, usually nitrogen, is used in order to avoid any degradation of the Polythene. The welding process is very readily carried out and consequently great use has been made of Polythene extruded pipes, particularly for effluent and drainage systems. Their use eliminates the need for the conventional spigot and socket type of salt-glazed earthenware or chemical stoneware with the attendant difficulties in the making of sound, tight, chemically-resistant joints.

In practice, some 30 or 40 ft. of pipe can be welded together and then carefully rolled into the prepared trench. Normally the pipes are filled with water and the pipe trenches can

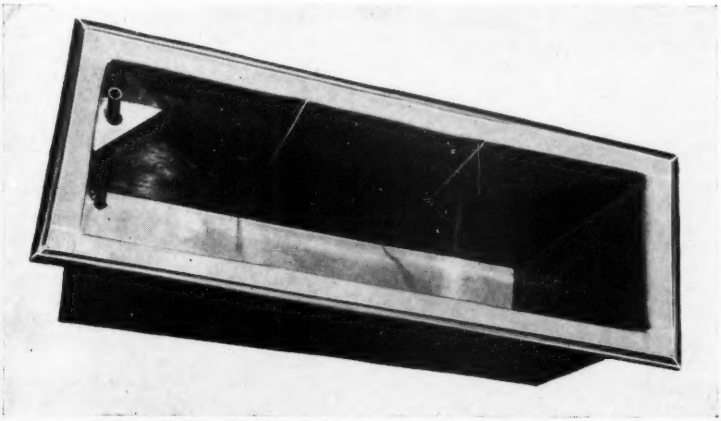
then be filled in immediately with concrete. Although Polythene has even greater thermal expansion than rigid P.V.C., it has been found that pipe lines bedded in the ground are normally able to withstand the expansion due to their small temperature variations without special provision for expansion bends. For constructions above ground it is necessary to allow for expansion by expansion bends or other suitable means. By using extruded Polythene pipe lines in conjunction with Polythene sheet, manhole linings and catchpits fabricated with sheet can be directly welded to the pipe lines and thus form complete effluent and drainage systems, including joints, entirely in Polythene.[1] Use has also been made of the smaller diameter pipes for cold water services.

"Keebush"

Considerable use has been made of thermosetting resins of both the phenol formaldehyde and furane types, blended with asbestos and other fillers to give the proprietary material known as "Keebush." Details of manufacture and fabrication are essentially secret processes, but the resins and fillers are blended, giving a plastic product which is applied to moulds and formers of suitable size and shape without the use of pressure. The resin is then further condensed so that hard, tough castings are obtained. The moulds are stripped from the casting and any rough edges, projections, etc., trued by suitable machining.

An important feature of this technique is that by using special cold setting cements, welding of fabricated pieces of equipment can be carried out to build up quite large and complete structures. Normally, single piece mouldings are not made in larger units than about 2 tons in weight, but it is quite easy to bolt sections together, using flanged joints. In fact, large pickling tanks for the descaling of long tubes have been cast in sections, which, when bolted together, have total lengths of some 60 ft. Apart from tanks, equipment such as absorption and washing towers, fan impellers, chimneys for chemical fumes, and chemical plant in general, have been constructed successfully in this type of material.

This material has the advantage that it can, in general, be used with temperatures up to about 130° C. The material, based on phenol formaldehyde resins, is resistant to acids (except oxidising acids), mild alkalies and some solvents, whereas the material based on furane resins is resistant to acids, strong caustic



A swill tank for the plating industry fabricated in ⅛ in. rigid P.V.C. incorporating 1 in. combined overflow and outlet pipe

alkalies and most solvents; the furane based material is less resistant to oxidising acids than the phenol formaldehyde type.[5, 6]

Use of Glass Fibre

Recent developments in the use of glass fibre impregnated with synthetic resins provide another interesting constructional material. Polyester resins have been used for impregnation purposes, and tanks for holding petrol, oil, etc., have been fabricated entirely by this means. One application has been for petrol and diesel oil tanks for trucks in Eastern countries where the corrosion of normal steel tanks has been very severe under the climatic conditions prevailing. In this application, two 1,000 gal. glass fibre-polyester tanks were fixed to the chassis of the truck. Another interesting development has been the use of resins prepared from furfuryl alcohol for impregnating the glass fibre, thus giving an extremely chemically-resistant material. This has been used to form chemical storage vessels, constructed entirely in the resin-impregnated glass fibre, and for membranes for tanks behind brick and tile linings, and as underlays beneath corrosion-resistant floors. Further important developments can undoubtedly be expected in this material.

Turning towards smaller items of equipment, mention must be made of the use of phenol formaldehyde and furane resins for the impregnation of graphite. Graphite has, of course, excellent chemical resistance and also good thermal conductivity, but is inherently porous. By suitable impregnation with thermosetting resins of these two types, and subsequent curing of the resin, the porosity is overcome and the resultant product, usually known under the name of "Karbate," has been used for pipes, constructional units such as bricks and tiles and heat exchangers. These products can be readily machined and also jointed together with special resinous cements.[7, 8, 9, 10]

Among other applications may be mentioned the use of polytetrafluoroethylene (P.T.F.E.) for special gaskets, sealing tapes and sealing discs. This plastic material is unique in its chemical resistance, practically all chemicals except fluorine and molten alkali metals being without effect on P.T.F.E. It is also resistant to temperatures approaching 300° C. P.T.F.E. is extremely expensive and consequently can only be used for exceptional applications.[11] Other special gasket material has been moulded in silicone rubbers. Polyvinylidene chloride has been used for chemical piping, and both P.V.C. and Nylon fibres woven into cloth have been employed as filter cloths in filter press work.

Linings and Coatings

In the lining and coating fields it is difficult to make a clear distinction between these two terms so that they will be considered jointly to some extent, dealing first with linings and coatings of substantial thickness, and secondly thinner coatings which may be considered to some extent as specialised paints. Several of the plastic materials already mentioned will be met with again. Brief consideration will be given to some of the synthetic rubbers used in this field, but natural rubber, although a plastic, is excluded from this survey.

Synthetic rubbers in the form of compounded sheets have been used as linings to both metal and concrete vessels, much in the same way as with natural rubber. Neoprene (polymerised 2-chloro-butadiene) is frequently used in cases where good resistance to oils and fats are required. By co-polymerising isobutylene with a small proportion of butadiene, which gives a degree of unsaturation allowing vulcanisation to be carried out, Butyl rubber is obtained, which has very good resistance to oxidising acids and to liquids at temperatures of 60°-110° C. By polymerising isobutylene alone, polyisobutylene is obtained, which has very good chemical resistance but is rather soft mechanically. For this reason it is preferably used as an impervious lining or membrane behind linings of chemically-resistant bricks and tiles set in suitably chemically-resistant cements.

Many of these rubber-like materials, including plasticised P.V.C., are frequently used in this way. As such, they take care of any leakage through the tile or brick lining which may be due to the use of a porous cement, or to incompletely filled joints or to

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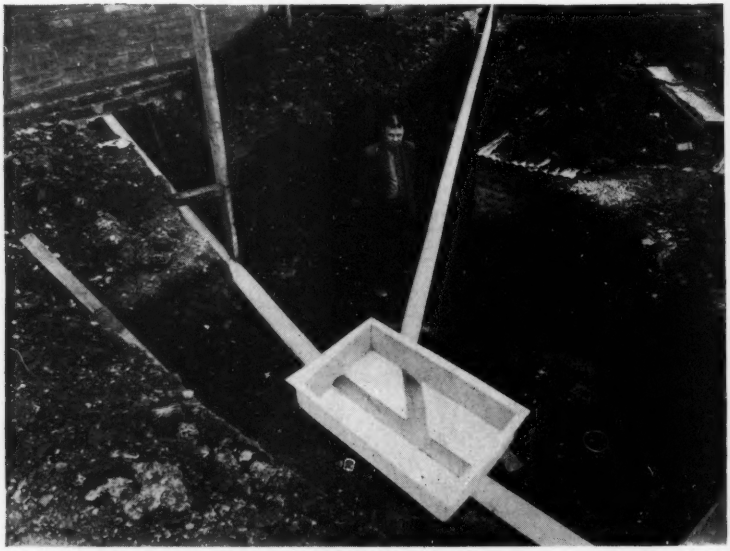
cracks in the brick lining caused by movement due to thermal expansion. Conversely, the tile or brick lining may be said to protect the impervious plastic membrane and lining from mechanical damage, and also to act to some extent as a thermal barrier between hot liquor in the vessel and the plastic lining. In fact, both linings are complementary to each other and very frequent use is made of such composite constructions in practice.[12]

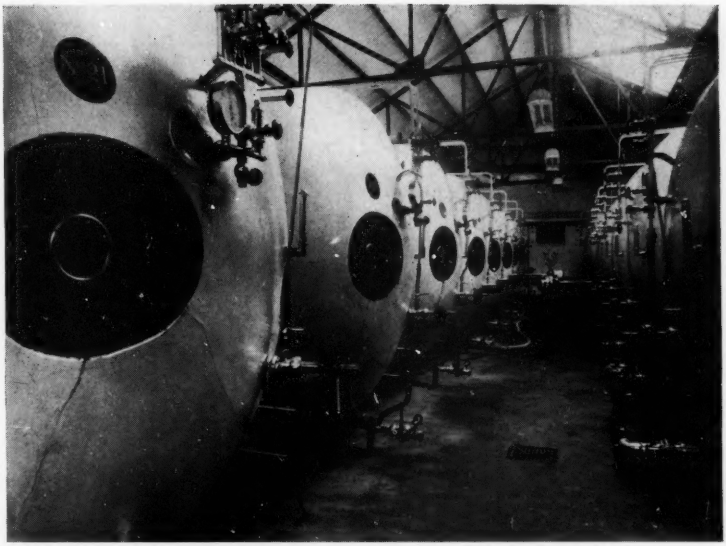
Perspex Linings

Polymethylmethacrylate (Perspex) is available in transparent and pigmented sheet about $\frac{1}{4}$ in. in thickness, and sheets are cut and a "loose" lining fabricated which is "tailored" to just easily fit into the tank or vessel. Jointing of the Perspex sheets is carried out by using a special cement or "dough"; this is applied to the joints whilst the sheets are clamped and then the dough is polymerised to a hard, tough solid by the aid of ultra-violet light. Clamps are removed when polymerisation is completed. In this way very attractive loose linings can be fabricated and Perspex has good resistance to alkalies and acids of moderate strength, but solvent resistance is poor and working conditions should not exceed temperatures of 60° C. One feature common to all "loose" linings is that old vessels, even wooden ones, can often be lined by this means. Perspex is rather expensive and the "dough" jointing method somewhat time consuming, and for these reasons modern practice is generally to use Polythene and rigid P.V.C. for loose linings.

Polythene is also available in sheet form, and for loose linings thicknesses of $\frac{1}{8}$ in. or $\frac{1}{4}$ in. are usually used, depending on the size of the lining. Sheets are joined by a welding process, as already described, and quite large linings have been fabricated by this method, as, for example, a tank lining 15 ft. by 7 ft. by 5 ft. deep. Polythene has a very large coefficient of thermal expansion—some 15-20 times that of steel—and as no very satisfactory adhesive for Polythene is available as yet, it is essential



6 in. diameter effluent drainage system and manhole fabricated in $\frac{1}{4}$ in. polythene sheet and extruded tube. (Polythene manufactured by I.C.I. Ltd.)



A battery of Prodor-glass lined beer conditioning tanks

to use "loose" linings. In the case of large loose linings it is usually advisable to employ some form of anchor to the vessel owing to the very flexible nature of Polythene. One method is by the use of bolts, which pass through holes cut in the Polythene but large enough to allow plenty of movement; the bolts are then covered by welding caps over them on to the Polythene sheet. Polythene linings have been successfully used in acid storage tanks, dipping tanks, neutralising pits, sumps and catch pits. When using Polythene in situations in which it may be exposed to direct sunlight, it is essential to use Polythene compounded with a small percentage of carbon black; this material inhibits any degration caused by ultra-violet light.[13, 14]

P.V.C. Linings

P.V.C. has very important applications as a lining, and may be considered under three different forms, as flexible, highly-plasticised P.V.C., slightly-plasticised P.V.C., and rigid, unplasticised P.V.C. Highly plasticised P.V.C. is available in flexible sheets somewhat similar to rubber, and is used as a tank and vessel lining much in the same way as sheet rubber to both metal and concrete vessels. It is less tough than rigid P.V.C., and for this reason is often used as membrane linings behind corrosion-resisting linings built in suitable bricks and tiles, and corrosion-resisting cements.

P.V.C. in the plasticised form has nearly the very good chemical properties of rigid P.V.C., and consequently can be used with oxidising acids and other chemicals for which normal rubber is unsuited. Slightly-plasticised P.V.C., containing about 10 per cent. of plasticiser, is also used for lining tanks and vessels. The lining process usually consists of cleaning the metal surfaces by shot-blasting and applying a special adhesive, followed by a paste on to which the P.V.C. is rolled. The sheets are jointed by welding, using the hot torch as already described, and the paste finally cured by the application of mild heat, usually using infra-red lamps. This causes the paste to adhere firmly to the

adhesive and to the P.V.C. sheets. By careful selection of plasticisers it is possible to compound P.V.C. sheets which can be used with foodstuffs, etc., as well as chemical applications.

With rigid P.V.C. two types of lining are available. The first type uses a thin P.V.C. sheet or foil some 0·5 to 1·0 mm. in thickness and is mainly used with metal vessels. The metal is prepared by shot-blasting and then coated with a special adhesive. This is allowed to dry by solvent evaporation, and small areas of the vessel are heated externally by blow-lamps, and warmed sheets of P.V.C. foil are rolled on to the inside of the heated portion of the vessel. On cooling, the foil is firmly adhered to the vessel and by continuing the process the whole vessel can be lined. The joints between the sheets are made by the usual welding method, thus giving a tight, firmly adhered coating with outstanding chemical resistance. P.V.C. rigid sheets of thickness $\frac{1}{8}$ in. to $\frac{1}{4}$ in. are also used to form "loose" linings, much in the same way as Polythene linings, but owing to the greater rigidity of P.V.C. the anchoring of sheets is not normally necessary. P.V.C. linings have been used for a variety of purposes, including pickling and etching tanks, acid storage vessels, processing, electroplating and dipping tanks, and also for foodstuffs and beverages.[15, 16, 17]

(*To be continued*)

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Mr. Geoffrey D. Butler has joined Mander Brothers Ltd., Wolverhampton, as general sales manager on the paint side. Mr. Butler has spent the whole of his business life in the paint trade

"THE BONDERIZER"

THE September issue contains a short, interesting article on the Saint Freres circular loom, which is being manufactured by Urquhart Lindsay and Robertson Orchar Ltd.; this is a new development of great significance in jute weaving. The Parkerizing process is used on many of its components. Reference is also made to Berry's Electric Ltd. and the Bonderite protection given to their "Magicoal" electric fires.

Other applications of Bonderite for both zinc base alloy and steel as well as "Parco-Lubrite" on internal working parts are described with reference to the "Time-Master" Dictaphone.

Pretreatment Etch Primers of the Single Solution Type

PART I

by E. E. HALLS

THE two-solution type of etch primer is an established first coating medium in the metal finishing sphere. Developed and introduced into American practice during the war, it proved its value as the basis of simple paint protective systems on both steel and aluminium. During the past three years or so it has been finding regular use in England, and its success has not only been associated with specialised applications, such as those of ensuring paint adhesion on zinc and cadmium-coated surfaces, but also with more general usage in industrial metal finishing shops that have to deal with a miscellany of articles of all forms, shapes, sizes and compositions. In some cases it has been the means of solving difficult finishing problems; in others it has resulted in simplified practice, greater productivity, and lower cost. In all instances it has signified an improved finish from the performance point of view.

Limitations

The two-solution make-up has been necessitated by the very nature of this type of primer. Briefly, the formulation is based on a resin solution containing a suitable inorganic acid, one function of which is to gel the resin to a film-forming condition, and another is to etch the base metal to which applied. The problem has been to provide such a mixture in which the gelling does not occur in the container before the primer is applied to the job. Thus the necessity for supply in two portions, the resin solution in organic solvents, also carrying the corrosion inhibitive tetrahydroxy zinc chromate pigment, and the acid solution supplied in glass containers, to be added as thinners immediately prior to application to the job. The shortcomings of this apparently simple procedure become apparent upon consideration of the properties of these media, and have certainly been encountered by users.

The two solutions must be mixed in precise proportions, although it can be arranged for a simple ratio of 1 to 1 or 2 to 1 by appropriate formulation. The mixing must be thorough and not a mere twirl around with a stick, otherwise the composition as applied will vary over the article. A period of 15 min. standing after mixing is desirable before use, although not essential. The mixture has limited life, 8 to 12 hours being the maximum, so that the precise amount required in a working period must be calculated, or excess thrown away. After this period, there is not necessarily any visual indication of deterioration, but adhesion is very poor indeed. Therefore the operator has no warning, and a rigorous system of control is essential.

No Real Deterrent

These limitations provide no real deterrent to the use of two-solution etch primers. Moreover, in an organisation in which a proper mixing section can be provided, and the finishing media issued to the paint shop on a flow basis in relation to the work scheduled, no real difficulties are encountered. With smaller establishments, in instances where requirements are intermittent, or for finishing on site, the extra drill to be instituted to ensure no failures can be disconcerting, although again by no means impossible.

To these points, again, must be added the stocking sections problems, the ordering and storage of two items

instead of one, and these in balanced quantities. The net result has been an urge to develop a similar material in a "one-can form." Such a material, stabilised so that reactions do not occur prematurely in the container, and so that no reaction takes place with the material (tinned steel sheet) of the container itself, has been produced and in successful use for a year or more.

Single Solution Type

Tests have shown that the single solution type of self-etch primer is stable in storage for a period of at least six months, even if temperature is somewhat elevated (40° C., 104° F.). Practice has shown that the material is usable with successful results. Accelerated corrosion tests indicate that results are good, but not necessarily always as good as is obtained with the two-solution type of material.

These single solution primers have required considerable time and effort for their evolution to the standard attained. Work continues, so that it may confidently be expected that, within a reasonable time, single solution media will be equal to the best of the two-solution materials. In the following, single solution etch primers from three different sources of supply (Nos. 1, 2 and 3), are considered, from the testing result point of view, against a good two-solution type (No. 4) for comparison.

All of these materials were used on the test panels in the manner stipulated by the respective supplier. That is, Nos. 1 to 3 were merely diluted to spraying viscosity with solvent thinner, and No. 4 was prepared by the thorough mixing of two parts of the primer base and one part of the acid solution immediately before use.

The base materials chosen for the test panels were aluminium and brass. The former was chosen as representing one of the lesser reactive of the reactive group of metals (aluminium, zinc, iron or steel, zinc and cadmium), and the latter as a difficult metal for enamel adhesion.

Test Conditions

The test conditions comprised severe wet heat and salt spray exposure. The wet heat was applied after first exposing the panels to dry heat of 16 hours at 70° C. It consisted of daily cycles of 16 hours at 70° C. and 100 per cent. humidity, followed by cooling off to room temperature in the test cabinet, thereby causing condensation of water upon the specimens.

The salt spray conditions were the standard ones of 8 hours spray from 20 per cent. salt solution atomised with clean moist compressed air, the specimens being left in the mist-laden cabinet for the remainder of the day. The test was conducted at room temperature. The samples were washed in cold running mains water each day, and dried on a soft cloth for examination.

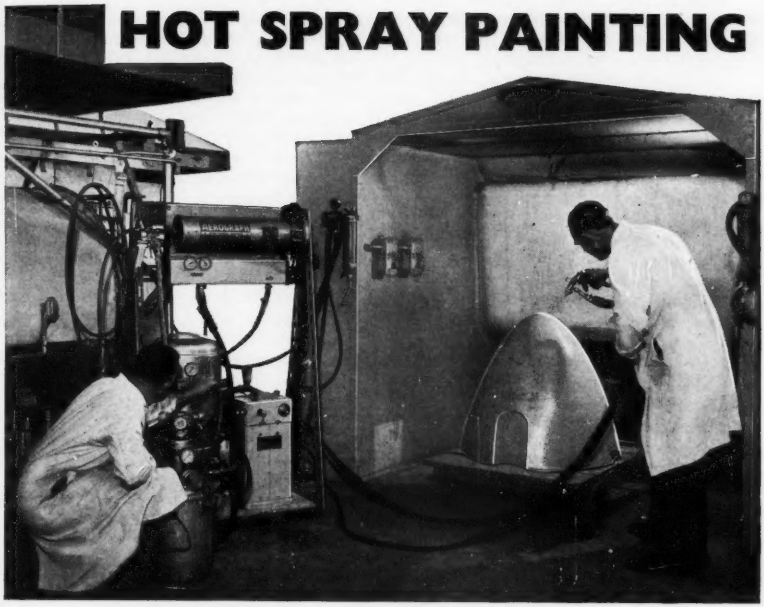
Assessment of Enamel Quality

Quality of enamel finish under the test conditions was assessed by visual changes such as blistering and flaking, and hardness and adhesion of the film to thumbnail scratching. At the end of the test it was also evaluated from scratch and bend tests. It should be noted that during the tests some soluble chromate tended to leach out, this to be expected from the inhibitive chromate pigment. Again, especially under the hot wet tests, and towards the beginning of this test, the finish film tends to be relatively soft, and to recover to a hard adherent film upon drying out for a day or so at room temperature. Some indication of this is given in the tabulated data.

The test specimens were prepared by thorough degreasing in trichlorethylene. The primers were examined as single sprayed coats, both air-dried and stoved for short and long periods. They were also assessed with single finishing coats of enamel of air-dried cellulose and stoved synthetic types.

The suspended solids in all the primers except No. 2 were soft and easily stirred into suspension; in No. 2 it was rather hard, making uniform mixing a little more difficult. After storage of the three ready-mixed primers at room temperature for approximately 6 months, their ease of preparation for use and manipulation through the spray gun was unchanged. The three single solution materials were also sealed in tinned steel containers and held in an oven at 40° C. for a period of 3 months, and then examined. They showed no deterioration, that is, no visual or apparent

HOT SPRAY PAINTING



How to Control the Finish—from the Start

The great advantages of Hot Spray painting are only just being realised. For many industrial purposes the use of the pre-heating process will give an excellent finish much more quickly, with less labour and with an appreciable saving in cost.

For those who want to know more about it, the Demonstration Centre offers full facilities for practical demonstrations on customers' own products. What is more, we will gladly train paint-shop operatives at specially arranged, short intensive courses—at no cost or obligation to the customer.

This is *your* opportunity to gain impartial and unbiased advice on the process that is revolutionising many industrial finishing procedures. If the process is suitable for *your* product, we will show you how best to use it. If it is *not* suitable we will save you expensive "trial and error".

The photograph shows a corner of the Demonstration Centre with operators hot-spraying synthetic enamels at the water-washed spray-booth. Three types of paint heaters are shown in the illustration. Take advantage of this "know-how" and let us help you to *control* your finish.

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change as far as ease of mixing for spraying and in application was concerned. Further, applied to brass and aluminium, air dried or stoved, and overcoated with stoved synthetic or air drying cellulose enamel, the results obtained compared favourably with those obtained on the same materials when freshly delivered from the supplier. The quality of these materials with respect to good "can stability" is, therefore, deemed to have been established.

With regard to the accelerated conditions tests, the results have been briefly summarised separately for the finishes on aluminium and on brass, and are given in Tables 1 to 6. Primers Nos. 1, 2 and 3 are the single solution type, and No. 4 the two-solution material.

The tables which contain details of the test results summarised below will be published as Part II of this article, and will appear in the November, 1952, issue of INDUSTRIAL FINISHING.

Test Results

Table 1 deals with the initial assessment made by scratch and bend tests two days after completion of the finish. Reviewing the results in a comparative manner, primer No. 1 gives rather poor performance in all cases when air dried because it is soft, and it is not too good even when stoved, when followed by the air dried enamel. The others, air dried, vary from moderate to very good, No. 3 being comparable with the two-solution job. The all-stoved systems, even when the primer is air dried, and one stoving relied upon after applying the top enamel, all showed up very well indeed.

Table 2 shows the initial assessment of the finishes applied to brass. The same conclusions can generally be drawn, and with primer No. 1 showing the least favourably.

Table 3 summarises the performance of the finishes on aluminium under salt spray conditions. Extensive comments are not necessary. The behaviour is quite good throughout, with No. 1 primer the poorest, and Nos. 3 and 4 the best.

Table 4 gives salt spray results for the brass specimens. Resistance was not so good as on aluminium. Primer No. 3 did not show so well in this series, and the two-solution type was superior throughout.

Table 5 gives details of the hot wet test on the finishes on aluminium. Of the air dried finishes the primers alone all performed well. Primer No. 1 with cellulose enamel, behaved poorly, and the other samples satisfactorily. Primer No. 4 gave best results with the air drying systems. Stoved primer with cellulose enamel also revealed the weakness of primer No. 1 and the relative weakness of primer No. 2. Stoved finish on air dried primer again showed primer No. 1 to be poor, and No. 2 relatively poor. Primers No. 3 and 4 behaved very well throughout the series.

Table 6 covers hot wet tests on the finishes on brass. All the primers alone, air dried and stoved, performed very well, but with finishing enamel applied, all the single solution primers (Nos. 1, 2 and 3) were relatively poor, the two-solution type in contrast being very good.

Conclusions

In the above, a critical examination of finished panels has been presented. Further, the tests to which subjected were severe and the two-solution etch primer that formed the basis of comparison was one established in experience to be very good. Any judgment made must be qualified accordingly. Nevertheless, the following conclusions are hazarded:

1. The two-solution primer, air dried or stoved, and followed by cellulose or stoved enamel, is outstandingly good.
2. The films from single solution primers tend to retain some degree of softness unless stoved.
3. Single solution primer No. 1 showed up rather poorly, giving poor salt spray resistance on brass, and poor wet test resistance on both aluminium and brass.
4. Single solution primer No. 2 was generally superior to No. 1, its main weakness being under hot wet tests on brass, but it also showed some indifference in the other tests.
5. Single solution primer No. 3 was generally the best of the three, its chief weaknesses being under salt spray and hot wetness when applied to brass.

From these conclusions it can be decided that the single solution etch primers are a satisfactory commercial product, but that the best available should be chosen from laboratory test. Further, improved performance is assured by selecting the most compatible finishing enamel for the purpose, and again by employing a stoved system wherever practicable. At the same time, where two-solution etch primers are already established, and the mixing problems referred to above satisfactorily catered for, there is no reason to change to a single solution type at this stage. On the other hand, where troubles have been encountered, or for the small user, or for the application in difficult situations such as "on site," the single solution primer is a boon to users, and with discreet selection, should give entire satisfaction.

Finally, it must be stated that further commercial developments have occurred subsequently to the above testing, which, of course, covers a period of some months. The gap between the quality performance level of the two-solution and single solution primers has been narrowed, but the extent of this improvement can only be given when full test results are available.

The rapid progress in the development of the production of etch primers of satisfactory performance is something to be commended, and the industrial finishing shop must respond to this achievement on the part of the paint manufacturers by ensuring proper selection and correct usage.

Correspondence

ELECTROPLATING ALUMINIUM

SIR,—The writer has just read the account published in your June issue of the discussion on electroplating of aluminium. We feel that we should put forward one or two points on this subject as we have been electroplating aluminium and its alloys for some many years. We find that there is no hard and fast process for this operation—indeed—we find that specific alloys have to be varied in their processing according from whence they came. We can say however that aluminium can be electroplated with every satisfaction as regards to adhesion with all forms of deposition.

This claim applies equally to certain alloys of aluminium although we find that certain casting alloys which contain fair proportions of magnesium do present difficulties. That even these can be electroplated is perfectly true but we like to put the pieces through pretty stringent tests such as heating and quenching to see if the plate will lift or blister. The various techniques have to be found by actual trial as we have already stated there is no set method insofar that a few minutes extra deposition in the initial stages may upset the processing. But surely the use of zinc as the initial deposit is governed to a large extent by the fact that it is nearer in the electro potential series and other metals would set up a reaction in the presence of moisture.

What does present a big problem is the plating of extrusions. The process of manufacture seems to induce into the metal some of the lubricants used as we have already discovered by the fact that a piece of aluminium may be plated perfectly but as soon as it has been formed up by say a drop hammer forging using tallow as a lubricant then blistering occurs. This is sometimes overcome by pre-heating the metal but even so it does not always work. The pre-heating of the aluminium in the case of castings does drive out any gas which may be present, as in our experience most of the castings are made by foundries who have little or no idea, not that they would care much if they had, of the problems of the electroplater. We find that if the aluminium mix be de-gassed by means of any of the excellent preparations available then this first heating is not needed.

The same principle applies to aluminium which has been polished. After all it is quite an art to polish aluminium, and if one studies the surface after polishing one can see where the metal has dragged and in the case of tiny porous holes then the compo used by the polisher has been trapped. Subjecting the metal to heat beforehand does drive out any of the volatile parts of the compo before plating and does not expand, which it would do when the plated aluminium is polished and heat

produced. For this reason it is always better to polish the aluminium bearing in mind the heat produced and which tends to open up the surface and entrapping the compo.

In short there are many techniques to be used. Some folk may say there are tricks to every trade and in the case of electro-plating aluminium this is perfectly true. Logs and data must be collected for each alloy and times, etc., taken careful note of, and when one realises the not inconsiderable alloys available some idea will be given that this form of processing must be a job for the specialists. When, of course, one is dealing with fairly pure metal then the troubles disappear except, as we have said before, in the case of extrusions or forms fabricated by similar means. Aluminium may be plated and soldered easily and silver plated aluminium is well know in the electronics industry.

C. HUNT, *Director*,
A.E.R. (1938) LTD.

196 Great Cambridge Road,
Enfield,
Middlesex.

TECHNOLOGICAL COURSES

SIR,—It is with interest we note on page 115 of the September publication of INDUSTRIAL FINISHING notes on Technological Courses. It may interest you to know that at the Stourbridge Art and Technical School, Stourbridge, Worcestershire, for the past two years courses have been running entirely for the Theory and Practice of Vitreous Enamelling, and this year a third-year course, in addition to the two mentioned above, will operate. The writer is a Governor of the above School, and also the liaison between the vitreous enamelling industry and the Worcestershire Education Authority in so far as the work of this School in Vitreous Enamelling goes.

For ERNEST STEVENS LTD.,
D. BALDWIN,
Director and Manager.

TRETOPLAST

A DEVELOPMENT in packaging has been announced by Factron Products Ltd., of 14 North End Road, London, N.W.11, an associate company of Tretol Ltd. Known as the "Tretoplast" Spray Protective Packing System it has been officially approved by the Air Ministry and used in considerable quantities by various Government departments; it is now offered commercially.

The system is claimed to offer protection for delicate equipment or heavy vehicles stored in the open air for periods up to 10 years.

BRITISH STANDARDS

UNDER the heading Revised Standards Issued, in the Monthly Information Sheet of the British Standards Institution, are the following:

B.S. 272, 305, 370: 1952 Red oxides of iron for paints, 3s. 6d.—Covers in each case a description of the material, composition, residue on sieve, oil absorption value, colour, tone and staining power, matter volatile at 98-120° C., together with descriptions of sampling procedure and methods of test. In addition, limits of the content of carbonates and sulphates are specified in B.S. 305.

B.S. 306, 339: 1952 Black and purple oxides of iron for paints, 3s.—Covers in each case a description of the material, composition, residue on sieve, oil absorption value, colour, tone and staining power, matter volatile at 98-102° C., matter soluble in water, together with a description of the sampling and methods of test. In addition, a limit for sulphur and sulphur compounds other than insoluble sulphates is specified in B.S. 339.

B.S. 312, 313, 337: 1952 Sienna, amber and ochre for paints, 3s.—Covers in each case a description of the material, composition, residue on sieve, oil absorption value, colour, tone and staining power, loss on drying *in vacuo*, matter soluble in water, together with descriptions of sampling procedure and the methods of test.

B.S. 314: 1952 Ultramarine blue and violet for paints, 2s. 6d.—Includes a description of the material and requirements for residue on sieve, oil absorption value, colour, tone and staining power, matter volatile at 98-102° C. and matter soluble in water. The method of sampling and methods of test are given in the appendices. In this revision the wording of clauses and of methods of test has been modified where necessary to bring it into line with that of other standards for pigments for paints.

B.S. 851: 1952 Manufactured oxides and hydrated oxides of iron, 2s. 6d.—Covers description, composition, residue on sieve, oil absorption value, colour, tone and staining power, loss on drying *in vacuo*, matter soluble in water, together with descriptions of sampling procedure and the methods of test.

Chloride Batteries Ltd.—The Exide and Drydex depot of Chloride Batteries Ltd., at Bristol, has been moved to new premises in Whitehouse Street on the city's Bedminster industrial estate. The new depot extends over 20,000 sq. ft. and is one of the most modern and best equipped in Great Britain.

NOW – *for really* SPOTLESS PAINTING –

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Bright Nickel and Chrome Plating

by

FRANK SPICER

PERHAPS the most widely known type of electroplating today is that of chromium plating, it can be seen in almost every walk of life, clocks, shop-fittings, motor-cars, fountain pens, etc., in fact most of the metallic objects in use in everyday life have some part chromium-plated. Why this overwhelming popularity of chromium? Some of the reasons are that it is an extremely attractive finish, non-tarnishing, easily applied in thin deposits and at reasonable cost.

To be effective as a protective finish it must be applied over a substantial undercoat of nickel; you may ask why not nickel alone? The reason of course is that nickel alone is porous and quickly loses its lustre, and that chromium alone possesses little protective value, but the two used in conjunction are attractive and effective.

Bright nickel plating has become a standard feature of the majority of plating shops over the past ten years, and is proving successful as an undercoat for decorative chromium-plating, providing, of course, that certain precautions and rules are followed.

Recessed Articles

The successful plating of small articles possessing deep recesses has long been a problem, and in this article the author outlines the procedures adopted by him in the mass-production plating of such items as, ash trays, spoons, egg cups, and wrist-watches, etc. All these items were plated by the same procedure and solutions, and as an example I will take the most difficult, for purposes of illustration, i.e., wrist-watch cases.

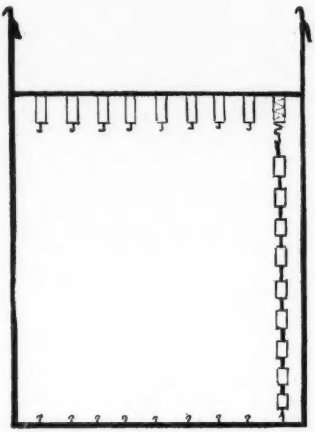
The main factor in complete coverage of these recessed articles with chromium, lies in a substantial undercoat of bright nickel, and by the adoption of an out of the ordinary chromium-plating solution as regards sulphate ratio, and temperatures, etc.

Wrist-watch cases comprise two parts, a back and a bezel, the latter gave little difficulty, but the successful plating of the back was a different proposition. As will be seen in Fig. 1 the back itself is of simple design, but to successfully plate it gave rise to many problems, such as, insides were unplated, particularly the inside of the matt at point "D", there were also plenty of strippers.

Fig. 1

The materials of construction were nickel/silver and matt and back were silver soldered, after soldering they were cleaned and bright dipped and passed to the polishing shop.

The use of spinner work holders, increased production, but tended to leave deposits of polishing compound trapped between matt and back at point "D", it was found necessary to put in a liquor/vapour degreasing operation between polishing and colouring. If left until the two operations were completed the compound became hard and almost a fixture, proving extremely difficult to remove.



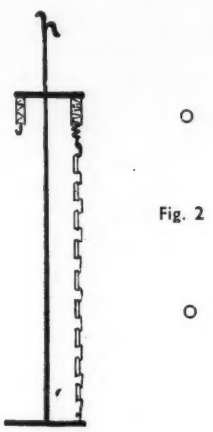


Fig. 2

The backs were racked using a double-sided spring-loaded rack as shown in Fig. 2, special hooks were manufactured from off-cuts of nickel silver, as shown in Fig. 3. Each rack carried a gross of backs or bezels, and to facilitate loading the use of a swivel loader was adopted (Fig. 4).

Plating Sequence

After racking they were passed for plating, the sequence being as follows: Cold electrolytic clean, cathodically, for 3 min.; cold electrolytic clean, anodic, for 30 sec. (using a separate tank); rinse; acid dip 10 per cent. sulphuric acid; rinse; cyanide copper plate 1 min.; rinse; acid dip 10 per cent. sulphuric; rinse; rinse; bright nickel plate for 15 min. at a current density of 60 amp./sq. ft. at a temperature of 80° C. in a cobalt type solution; rinse; rinse; chromium plate, 3 min.; rinse; neutralise; rinse; acid dip, 10 per cent. sulphuric; rinse; hot rinse and dry off.

The electro-cleaners were changed weekly, as were acid dips; all rinses were emptied and cleaned at the same time. The reason for the frequent changing of the cleaning solutions was a bad period of stripping, and as they were cheap, and the tanks were of only 200 gal. capacity it proved well worth while. If for some reason cleaners were operated for a longer period than two weeks, stripping again occurred whereas by frequent changing of the cleaners the flaking of components became virtually non-existent.

The bright nickel solution was analysed twice a week and the necessary additions made, which were only in small quantities, i.e., not causing any radical change in solution balance. The *p*H was checked twice daily, and the plating out of the solution on to corrugated sheets was carried out weekly during one night at a C.D. of 2 amp./sq. ft.

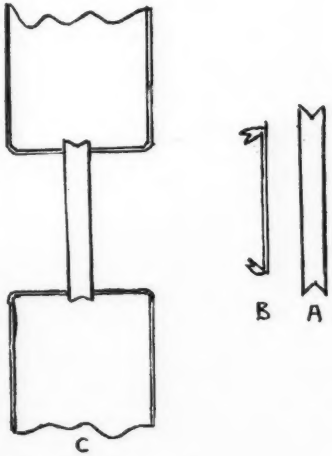


Fig. 3

The solution was continually filtered, through a 300 gal. per hour meta filter. Agitation was by both air and moving cathode rod, this not only kept porosity at a minimum, even where components required a deposit of 0·001 in. of bright nickel, but also allowed us to use high current densities when desired.

The chromium-plating solution differed maybe more than any other feature of the plant, in that it was operated at room temperature, and an interesting item was that the best plating was achieved during the coldest of the winter spells, and that during the summer months it was found advantageous to keep the temperature below 75° F. by circulation of the water through the jacket, the water then being passed into a rinse tank.

The saving in heating amply paid for the frequent discarding of the electro-cleaning solution. The sulphate ratio was kept near to 112:1, but never below this figure; it was not actually critical up to 140:1, but 112 gave the most consistent and best results. The articles were placed in the bath with a small amount of current flowing, this was then stepped up in approximately 3-5 sec. to 8 v. switched immediately back to 4 v. for the remainder of the 3 min.

The resultant plate was of a whiter appearance than that attained by using the normal solutions under ordinary conditions, the complete plating of all recesses was accomplished without difficulty, but upon leaving the chrome bath the cases bore the tell-tale blue stain resulting from a solution having a low sulphate content, this stain was easily removed by passing the rack through a 10 per cent. sulphuric acid dip, immediately before rinsing and drying.

You may ask, why all the various changes in procedure? Well, troubles were met and gradually eliminated, until the final layout as described was arrived at. Was it worth it? We thought so, for out of 25,000 watch cases, rejects for electroplating (this included, strippers, stained deposit, patchy plating, burnt plate, etc.) were ninety-seven.

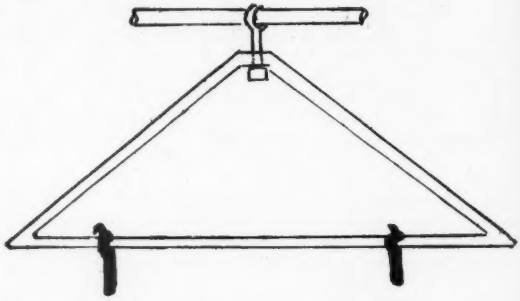


Fig. 4

DEWATERING FLUIDS

W. B. DICK AND CO. LTD., 43 Grosvenor Street, W.1., have issued a booklet dealing with the above subject. They are, of course, a world-war two development, primarily originating from the salvaging of submerged aero-equipment from sea water. The point was that as long as the material was submerged it suffered little corrosion, but as soon as it came in contact with the air after salvaging, the corrosion proceeded rapidly. By immersing the salvaged material in a dewatering fluid the water was removed and replaced by a thin layer of protective oil.

Cutting Costs

The booklet indicates how dewatering fluids act and outlines the various range of materials, numbering from one to twenty, each specifically defined in terms of external and internal protection offered by the residual film. Types of container and ideas on maintaining dewatering efficiency are offered as well as an outline of the various industrial applications. This booklet is well worth while perusal by the finishing engineer for there are many aspects of the finishing process, particularly cleaning, where the use of dewatering oils can cut the ultimate cost.

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PAINTING BY ROLLER

A Survey of Its Potential

TIME the American news magazine, in its issue dated 17th December, 1951, discussed paint application. It quotes one American paint executive, who says: "Painting has always been a messy, dirty, disagreeable job. With rollers it's a cinch for the housewife." He goes on to say that rollers have been known for some time, but that the old-fashioned roller was not much of an improvement on the brush, whereas the newer ones hold the paint inside a cylinder, letting it out through a rubber or fabric sleeve, which prevents dripping. He adds that: "Even the large brush-makers in America are beginning to sell rollers."

"Definitely Not Gadgets"

From time to time there have been mentions of the use of rollers in the British market—basically there is no objection to the idea, for in the tin printing trade paint has been applied by rollers, one of which takes up paint from a reservoir and coats the other, which in turn paints the tinplate—and the process has been used for many years. However, there is no doubt that among the paint and varnish makers in America tremendous interest has been aroused in paint application by rollers —one in a private communication says:

"In my opinion, rollers are definitely not 'gadgets' which will have just a temporary role. I believe without question that they will supplant a large proportion of brushwork. It is a great deal easier for an amateur to handle a roller than a large brush, the time consumed is much less (up to 50 per cent.), and the finished job is almost invariably more satisfactory. There is resistance to their use in some areas by the painter (chiefly where strong painter unions exist), but in other areas painters are using them to cut their costs.

"Rollers are not a cure-all, as none has yet been made in this country (U.S.A.) which will satisfactorily cut in a sharp edge. Consequently, it is necessary to use a small brush such as a 1-in. sash tool, to go around edges—this is followed by use of the roller on the major area to be painted. I know work is being done on this problem by the roller manufacturers, and hope they will be able to overcome it.

"There are various types of rollers. Our experience, to date, is that the mohair type cover is the best for use on most interior surfaces. It works very well with all types of wall coatings (oil base and alkyd) as well as varnishes and floor enamels. We are not recommending application of our high gloss architectural enamel by roller as we have noticed a tendency to pinhole. Currently we are concluding a series of tests on application of floor varnishes by roller, and the results look most promising. Our tests on floor enamels so far give excellent results—but are not yet conclusive. These tests have all been made on floors—we have not as yet tried roller application of varnishes and floor enamels on vertical surfaces.

"Lambswool covers are satisfactory for most types of interior paint application, and are excellent for application of heavy-bodied stippling materials.

Exterior Painting

"All of our work thus far has been with interior products. One roller manufacturer has recently come out with a roller for exterior wood siding. We do know that large exterior flat surfaces, such as steamships, are now being painted with large, long-handled rollers. The results are supposedly good but our knowledge is purely hearsay.

"One of the major reasons for the tremendous popularity of rollers in this country is the very high cost of jobs done by painters. Many people have been forced to do their own painting, and they have obtained remarkably fine jobs by rolling on the paint. The roller applicators are inexpensive compared to a good brush, and if the user fails to clean it after painting, all he has lost is the cover, which can be replaced at a moderate cost.

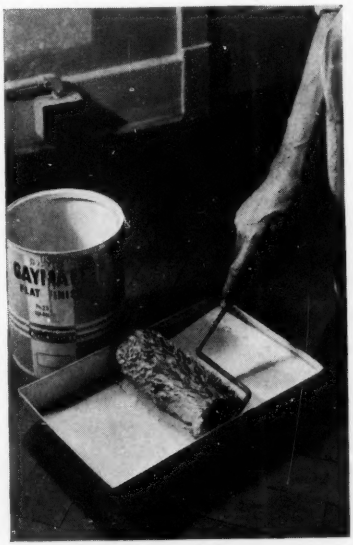
"The newest improvement is the addition of an extension handle. These were developed originally so that a person could stand on the floor and paint a ceiling—which I believe to be impracticable. We have used them, however, for putting on floor varnish and floor enamels while standing up. It makes floor finishing a greatly simplified job—and I personally hold great hopes for such application in promoting floor varnish sales.

"For good results in application the material being applied should be crossed, just as one would cross-brush. It is not necessary to roll vertically and then horizontally, but in any way that the material is cross-rolled so as to ensure solid coverage and an even, continuous film. This sounds complicated, but in practice it is simple.

Automatic Feed

"Some firms are making rollers that are automatically fed. The better ones employ the use of pressure tanks, and the paint is fed through a hose into the interior of the roller. We have one which we bought for test purposes, and it is used in plant maintenance with good results. The small rollers, which hold about a pint of paint inside the cover, have not proved as practical in our opinion as the regular roller which is dipped in a pan to pick up the paint.

"To my knowledge, paint manufacturers are not making special types of paints for roller use; rather, the roller manufacturers are trying to adapt their rollers to the needs of the paint manufacturer."



The roller is charged from a shallow tray having a sloping base

British Investigation

One British paint manufacturer has spent considerable time investigating the application of paint by rollers, and they mention three particular types, namely, (1) the Rolakoton; (2) the Roulor manufactured in England, which is a French product; (3) the Decoroller.

The Rolakoton

This is a mohair-covered roller, developed for both the household and decorative trade. From tests carried out in this country it appears to be very suitable for applying gloss paints, undercoatings, flat oil paints, water paints and emulsions. The roller leaves the surface with a fine granular texture much more pleasing than the brush marks usually encountered, although with some gloss paints the texture becomes so marked as to give an orange-peel appearance, with resultant loss of gloss. However, trial and selection of the gloss paint, which, if it has good flow, overcomes this tendency.

The Rolakoton has a diagonal seam joining the roller cover, which tends to cause the roller to creep sideways, and this can be used to lead the roller over the surface. It is charged from a shallow tray made of wood and having a sloping base. The paint is held in the deep end of the tray and the slope is used for distributing the paint evenly around the roller. Spinning the roller when not in contact with the surface should be avoided.

The Roulor

The Roulor is a lamb's-wool-covered roller, made in various sizes and fitted with a telescopic handle.

From tests carried out it seems to be an excellent tool for the application of the normal decorative paints, being particularly suitable for rough and irregular surfaces. It can be charged either

direct from a metal tray, or from a grid suspended in the material container. There is no creep with this roller.

The Decoroller

The Decoroller is a lamb's-wool-covered roller originally developed for the household market, but now being supplied to the decorative trade.

It is equally suitable for applying undercoatings, flat oil paints, water paints and emulsions, particularly where the surface is rough and irregular such as textured relief, brickwork or raised papers. Application of gloss paint tends to show orange peel. There is no creep on application but a straight roll in the direction which the tool is being pushed. Again, it is charged from a shallow metal tray, and spinning of the roller should be avoided.

It would seem that in charging these rollers two general methods are used, namely, by taking up the paint from a flat, box-like tray, having a sloping inside base, which is partially filled with the paint, or, alternatively, by running the roller down a metal grid which is suspended into a paint container or even a bucket.

Painting by roller is a suitable method for large surfaces, such as walls and ceilings

Practical observations seem to show that the first method for charging the roller is satisfactory, except that the tray must be kept on an "even keel," because it is shallow, being awkward to use on a scaffolding or steps, and likely to meet with disaster on trestles.

The grid method is much slower but probably a little safer, and is very popular in France with the Roulor roller.

The tests on these rollers were in fact carried out on some of R. Gay & Co.'s paints, namely, Walgay, Gaymatt, Impenetrable Gloss, and Gaymura Emulsion Paint, which were applied to hardboard, plasterboard, plaster walls and brickwork. The general conclusion was that application was both quick and easy, with little spotting, except with very thin materials, where a fine spray was given off. The spotting increased as the speed of application increased, but it was generally concluded that a quicker rate of application could be maintained without spotting than by a 3 or 4 in. brush. An even film with good obliteration by comparison with brush application was noted, although the film thickness is difficult to control and films which are too thick might be applied. Where the materials flash off too quickly there is a tendency to double coating on the roller overlaps. This might lead to the necessity of brush application of the first coats on absorbent surfaces.

The materials being tried were all fairly slow setting. The finish of each of the materials applied by roller resembled that obtained by a light spray or fine stippling, although the gloss paint flowed out to an even surface which did not show application marks other than slight orange peel. On brickwork and irregular surfaces the method was very satisfactory for the fluffiness of the roller permitted the paint to be pushed into the lower areas and holes. There were disadvantages, such as coating internal angles and cutting in to edges or where protrusions occur on a flat surface, as is the case with mouldings or electric switches, where a brush is still necessary. Charging the roller is relatively slow compared with the brush.

Roulor recommendations are that it can be used with success for lime distempers, gelatinous whitewashes and paints, including water emulsion, oil, matt and glossy varnishes. In its favour it is suitable as a quick application

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method for large surfaces such as on walls and ceilings, where excellent work may be done in record time. The particular point is that the paint can be spread and stippled in a single operation more quickly than by the alternate use of painting and stippling brushes.

In the marine trade, apart from interior decoration, the Roulor can be used for painting the hulls, especially with an extension piece—industrial applications include painting tanks, applying anti-sunlight blue to windows and greasing sheet metal.

The maintenance of the roller must be carried out with more respect than is usually shown to a brush. Cleaning after use is comparatively simple, but necessary. After use with aqueous materials wash under tap with soap and water. After oil-bound materials, using tray as a sump, remove paint material from roller by rolling into cleaning spirit. Remove surplus spirit by rolling on to a wad of newspaper and wash in soap and water. Allow roller to dry naturally.

In all cases the rollers can be fitted with replacement covers, and although the life of the cover depends upon the type of usage, manufacturers do claim some 2,000-3,000 sq. yds., which means in effect about four rooms per year for ten years.

Coverage

In terms of coverage, investigations have shown that with flat oil paint the rate of coverage is about 20 sq. yds. per hour, which is about 25 per cent. better than by brush. Paint consumption in yardage per gallon is certainly equivalent to brush application and possibly in excess of the latter.

According to the *National Master Painter*, July, 1952, it has been claimed that approximately 24 sq. yds. per hour per man has been covered with the roller, showing a saving in material of up to 12 per cent.

R. E. Berry said at the Conference of the Association of Painting Craft Teachers in May, 1952, on the engineering maintenance side, dealing with the same gang of painters, that a job which took 4,400 hours by brush application was completed in 3,350 hours by roller, with a reported 10 per cent. to 12 per cent. saving in the latter case as far as material was concerned. In so far as office decoration was concerned in an industrial town, when the roller was used for broader surfaces its output was 23·5 yds. per man, which seems a reasonable figure in accordance with present investigations.

Other Developments

Further developments in the U.S.A. include a pressure-fed roller such as the EZ Paint Rotomatic, in which paint is supplied from a pressure container into the centre of a nylon pile fabric roller on the pressure of a button.

Among the manufacturers of roller tools in this country may be included:

1. *Rolakoton:* Stevenson Bros., Lister Hills, Bradford.
2. *Roulor:* Roulor (Great Britain) Ltd., 414/416 Kennington Road, London, S.E.11. (Reliance: 3293.)
3. *Kudos Roller Paint Applicator:* Amalgamated Brush Co. Ltd., 134 Charles Henry Street, Birmingham 12.
4. *The Victory Decoroller:* John Palmer Ltd., Victory House, Somers Road North, Portsmouth.
5. B. Heymans, 122 Bethune Road, London, N.16.

Paint application by rollers is relatively new to Britain, but it does seem to have a definite place in the finishing trade, unless it is killed by over-enthusiasm.

In the preparation of the above notes, acknowledgment is made to R. Gay and Co., and Robt. Ingham Clark and Co. for permission to peruse their records of investigation in this field.

A CONTINUOUS *p*H RECORDER/CONTROLLER

A NEW Universal glass-electrode *p*H recorder, which now makes possible the automatic control of many industrial processes is introduced by George Kent Ltd.

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Fundamental Considerations in Stoving with Hot Air Ovens

A LARGE number of the hot air ovens in practical use for stoving are not always operated to best advantage. In the following, an attempt will be made to outline a few basic considerations for stoving, the theoretical fundamentals being presented in an easily understandable manner for the practical operator and the plant engineer in charge of a metal finishing department.

The basic oven types for paint finishing operations use as heating medium gas, high temperature hot water, steam or electricity. They may use natural convection of hot air, or have a fan and artificial air movement using forced convection currents of hot air for heat transfer. A third form is the use of radiant heat.

Whether a static box-type oven is used in the form of single-, double- or treble-cased design, or single or double conveyor oven types are used for continuous processing, the fundamental heat flow will be composed of the following heat transfer operations: first, heat transfer from heating medium to hot air, and second, heat transfer from hot air to the paint coating for evaporation of the volatile matter within the layer of paint on metal, wood, or whatever the solid substance may be.

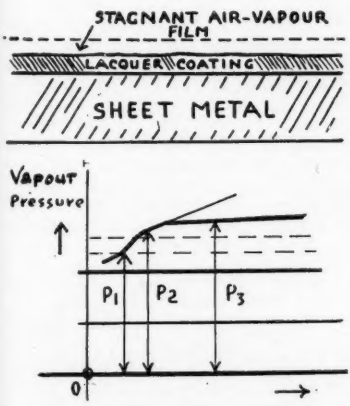

Fig. 1. Magnified sectional view of lacquered sheet metal with small air-flow when starting from cold. P1 = vapour pressure on surface of wet coating. P2 = vapour pressure on outer edge of stagnant film of mixtures of air and still solvent vapour. P3 = water vapour pressure in stagnant atmospheric air

In the case of varnishes or lacquers the drying process is performed largely or wholly by the evaporation of the solvent, usually requiring comparatively low hot air temperatures. In order to understand how efficiency of drying can be achieved, or can be increased with existing stoving equipment, a simplified theory of hot air drying of coatings should be given in the following instances where the paint film does not harden, and a low rate of evaporation is required. Conditions are different, of course, where a quicker rate of drying has to be achieved, and higher temperatures are required, as is the case with certain instances of surface hardening of the paint coating.

Qualities of Air

In order to understand any hot air drying process based on evaporation or "boiling out" of a liquid enclosed within the particles of material, or lodged between the solid particles, or on the surface, a few physical qualities of air have to be briefly mentioned. Air in a room or in a dryer is a mixture of dry air and of invisible water vapour. The amount of water vapour which air can absorb depends on (1) air temperature, and (2) relative humidity of the air. If air at a certain temperature is "saturated," it has a relative humidity of 100 per cent. and is unable to absorb more evaporated moisture during a drying process. An

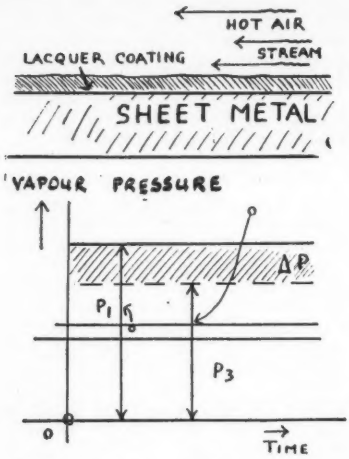

Fig. 2. Suction effect of hot air stream over lacquered metal sheet during stoving. P1 = higher solvent vapour pressure drives gasified solvent out from surface of coating. P3 = water vapour pressure of hot air stream flowing over lacquer surface. $\triangle P$ = vapour pressure differential P1 − P3

air volume can, however, be made to absorb additional moisture if it is heated up to a higher temperature, whereby its relative humidity drops. It follows that the higher air is heated before entering a hot air oven the more moisture or solvent vapours can it absorb per unit volume.

The invisible water vapour in the air has a certain vapour pressure. If, during oven drying of a lacquer, the solvent is gasified, it emanates from the lacquered surface as solvent vapour at a pressure which is higher than the vapour pressure of the air used for drying. The bigger the pressure difference between water vapour pressure in the air and the emanating solvent vapour from the lacquer surface, the higher will become the "suction effect" of the hot air used for drying. In other words, the pressure differential between water and solvent pressure determines the rate of drying. This should be clear from the following. Fig. 1 illustrates a paint coated metal surface with lacquer uniformly spread over one side. On the left is shown a sectional view of the metal sheet, with the lacquer coating on top of it, covered with a stagnant film of a mixture of air and of solvent vapour under cold conditions. When applying heat to the hot air, the equilibrium of the vapour pressure inside the coating and within the layer of the outer air and solvent film will be changed. Heat is transmitted from the hot air via the film to the coating material, and the solvent starts to evaporate. It "boils out" from the lacquer which latter becomes very fluid. The solvent vapours developed have a higher gas pressure than before, and penetrate first to the surface of the coating, then pass through the air and solvent film. Finally the evaporated solvent vapours reach the atmosphere, where a lower vapour pressure of humidity produces a suction effect on the hot, higher pressure, solvent vapour.

Fig. 2 illustrates roughly what has happened by application of heat transfer from hot air to the lacquer coating, expressed in vapour pressures. The highest solvent vapour pressure will occur near the surface of the lacquer coating, and the stagnant air-solvent film which was present in the cold state has disappeared. The hot air passing over the lacquer surface has a much lower vapour pressure than the evaporated solvent and thus develops a suction effect. The rate of evaporation or of drying depends, therefore, on the pressure differential between the invisible solvent vapour emanating under the influence of heat input from the lacquer surface and between the invisible water vapour pressure of the stream of hot air used. It should now be clear that one of the

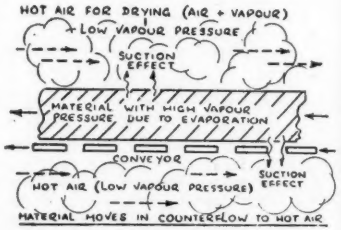
HOT AIR FOR DRYING (AIR + VAPOUR)
LOW VAPOUR PRESSURE
SUCTION EFFECT
MATERIAL WITH HIGH VAPOUR PRESSURE DUE TO EVAPORATION
CONVEYOR
HOT AIR (LOW VAPOUR PRESSURE)
SUCTION EFFECT
MATERIAL MOVES IN COUNTERFLOW TO HOT AIR

Fig. 3. Diagrammatic presentation of pressure theory of vapour movement during hot air drying in counterflow on conveyor

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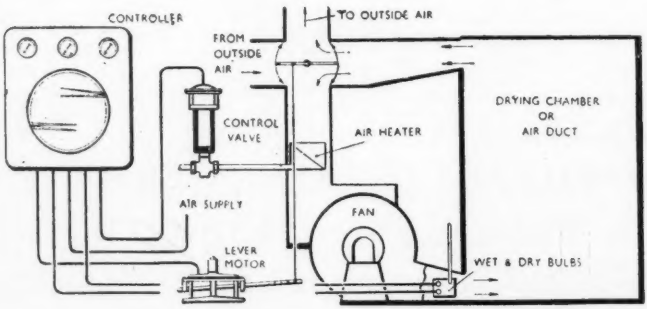
main factors to be influenced in lacquer or paint drying is to produce the correct heat input for evaporation of the solvent.

The problem is, however, more elaborate, because other factors influence efficiency of drying. The most important are the chemical and physical qualities of the coating material, but they cannot be dealt with in this survey, which must be confined to thermal factors, resulting from heat influence alone. The next factor is the way in which hot air is generated and applied in the oven. Air can flow over a coated surface in concurrent or in counter-current, if small lacquered or painted goods move in a conveyor oven. With concurrent flow the goods enter the continuous oven at the hottest point and space temperature drops as they move along. With counter-current flow the goods move in opposite direction to the hot air stream, and enter the oven at the point of lowest air temperature near the air exhaust. A third form of hot air flow is cross-current where goods move on a wire mesh belt and the hot air is blown at a right angle against the conveyor, either downward or upward. Very sharp drying can be achieved by using hot air nozzles with impinged air movement towards the goods.

Certain standard methods have, however, been developed for movement of hot air. It should, therefore, be noted that the main factors for dryer design are: (a) hot air temperature, (b) humidity of hot air, (c) velocity of the air stream toward the surface of the goods. To evolve an efficient oven is not as easy as it might look at the first glance. It is also somewhat difficult to deal with the subject of dryer operation, because the design of warm air drying machines or ovens varies widely, according to its purpose. There are, however, general points to be observed which apply to nearly every usual dryer.

Before a new hot air oven is put into operation, a clear conception should be made as to what the machine can do. Obviously one material will take longer to dry than another, depending on the solvent used. The most suitable rate of drying, and the stages of drying (surface, loosely bound and inner solvent evaporation) have to be found by experience, and sometimes by trial and error. The preferable method is by using some scientific method of finding out how the particular solvent can best be evaporated. By allocating to each drying phase the correct temperature and vapour pressure, good distribution and correct amount of air, efficient oven operation can be secured. For certain coatings "surface hardening" has to be avoided, and the "rising rate" of drying, the first phase goods entering an oven undergo, has to be kept moderate, i.e., too sharp drying in the beginning must be avoided. The function of a hot air oven is to supply and auto-



(Courtesy: Negretti and Zambra Ltd.)

Fig. 4. Combined temperature and air humidity control using Duplex control instrument and air damper adjustment for recirculation of part of exhaust air from dryer

matically maintain a stream of hot air at a desirable temperature and humidity. Both qualities have, however, to suit the material to be dried (Fig. 3).

Air Humidity

Humidity of the hot air in stoving operations plays a much lesser part than in hot air drying operations, for example, the drying of ceramics, and of chemicals, etc. Nevertheless, it has been explained before how relative humidity of the hot air influences the rate of drying. Whether the vapours created by application of heat are water vapours, or solvent vapours, they are more easily absorbed by a hot air stream of low relative humidity, i.e., being able to absorb a great amount of vapour emanating from the dried material. In hot air drying in general, recirculation of part of the exhaust air is therefore used to lower the rate of drying. By switching of part of the cooler but saturated exhaust air, and by admixing it to the incoming heated fresh air, it is possible to slow down the drying process. On the other hand, by letting the whole exhaust air pass out, and replacing it by fresh heated dry air, the rate of drying can be accelerated. A total recirculation of exhaust air would obviously have little drying effect. Correct adjustment of air dampers is thus most important for temperature- and humidity-control of hot air drying and for efficient stoving (Fig. 4).

Regulation of Air Velocity

This is controlled by fan speed and position of the fan damper. By increasing or decreasing the fan speed (increase works, however, only up to a certain point) air velocity and air volume can be adjusted, and an alteration between fan and motor pulleys can usually be made. Some oven types may have electrical speed control of the fan motor, or adjustable gear boxes, etc. Assuming the fan damper being wide open, fan speed and volume will vary together. For experimental (trial and error) purposes it might, however, be preferable to alter the damper position of the fan, situated between fan outlet and air duct at the bottom. The final adjustment of air speed and volume should be performed by the speed method, and the damper should be used during regular operation only to reduce down to, say, the half-closed damper position. Smaller damper openings might upset uniform air distribution into the various chambers of a zoned oven. Throttling of air in a duct is always somewhat disturbing to straight flow, and causes turbulence, with increased resistance.

Flow and Distribution of Air

Many ovens are in operation where air distribution is wrong, without being noticed as such by the operators. It is often possible to locate "dead spots" within an oven from the presence of underdried material. Sometimes an anemometer can be used in large continuous ovens of the tunnel or conveyor type to find out about uniformity of air distribution. Tests with smoke or visible vapours might disclose the path of flow of air. Leakages can easily be detected by smoke at suspected spots of air leakage in dryer walls or air ducts. It may sometimes be advantageous to make a rough plan of the plant, and to note in each corner of each chamber whether baking is slow, medium or fast, and to tabulate temperatures from portable instruments. It is then easy to adjust air flow after the first batch by adjusting the air regulators, and to repeat test runs. Where the suction of the exhaust fan produces very uneven drying in different chambers, control dampers in the exhaust ducts could be fitted and might even out air flows through various compartments.

It is obvious that hot air used for stoving painted or lacquered goods must be clean. To ensure clean air when recirculation is applied, a special air filter built into the recirculation duct might become necessary. This, and any other filter, must be kept clean during oven maintenance.

Loading, Position and Spacing

Experience and common sense will always be a good guide to the best location of the goods to be stoved. It can, however, sometimes be observed that prejudice in operation has produced wrong location of goods, or that with varying material the necessary loading adjustments are not being made. Loading of continuous

dryers should be performed according to the qualities of the goods. Where neither conveyor speed or spacing is correct, the efficiency of baking will be low with resultant uneven drying. Overloading of an oven does not achieve much, and where output seems to be too small, overloading cannot cure the trouble. A very common complaint from larger compartment ovens is lack of output from certain compartments, but by closer investigation it can usually be found that after certain adjustments under normal working conditions the rated output can be achieved.

The cause of prolonged or bad drying for steam-heated ovens can be traced to steam starvation of the heating coils, at least during peak periods of steam consumption in the works, accompanied by falling boiler pressure. Sometimes the heating coils have had heat transference due to deposits, waterlogging, air films inside, bad steam trapping, etc. A larger hot air volume by means of increase of fan speed might not help, because air volume rises only up to a certain point although exchange to a larger fan might sometimes be useful to increase output, provided the oven heating surfaces are large enough, or can be increased.

Vacuum Evaporation—Some Practical Considerations

CONSIDERABLE interest has been aroused in the application of metals to plastics, glass, pottery and zinc basic alloy die casting by the vacuum evaporation technique. It is, however, important to realise that the technique itself is far from one which merely entails the purchase of a plant with the hope that the user will be able to metallise successfully without any individual research and development. There are many potential pitfalls for the user, none of which are insuperable, but nevertheless they have to be overcome by trial and error methods.

Exhaustion Time

In the first place, it is important to remember that exhaustion times for the chamber are invariably based upon an empty chamber. When a workload of plastics, for example, is placed in the chamber to be evacuated, the time to reach the required vacuum is considerably lengthened, because a slow process of exhaustion of the volatile constituents in the plastics, particularly the plasticisers, must take place. This might well double or even treble the exhaustion time needed. After all, the manufacturer of plastics has not been asked in the past to give mouldings which of necessity will stand up to exposure under vacuum conditions, and there is no absolute certainty that the structural characteristics, apart from the volatilisation problem, do not change.

There seems obvious scope here for collaboration between the vacuum technique operator and the manufacturer of plastics. Up to the present the demand for special plastics for vacuum evaporation has been relatively small, but once the difficulties are overcome there is a vast potential market.

A similar problem is presented in the use of the various lacquers. One user reports extreme difficulty in obtaining a lacquer which will have the necessary degree of adhesion to the plastic—which will not bleed through the ultimate metallised surface which is only a few microns thick. And, finally, a lacquer which can be applied to the metallised surface without in turn interfering with the base lacquer. Again, lacquer manufacturers are faced at present with a relatively small market, but once more co-operation between them and the metalliser might conjointly result in a considerable future market.

Another difficulty is undoubtedly

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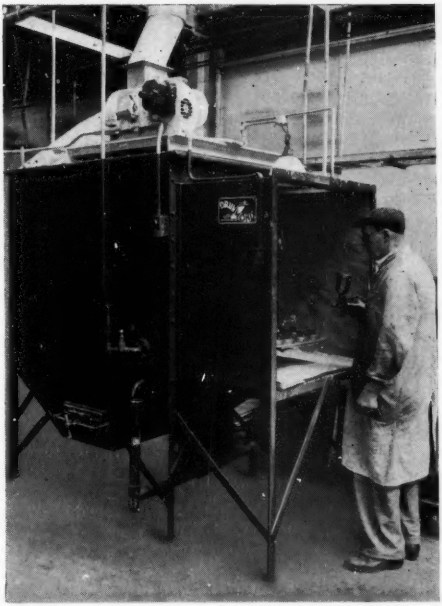

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the necessity to work at highly reduced pressures—if these can be suitably reduced, then of course the time schedule can be cut considerably.

In this metallising technique, the important thing is commercial production. It is, for example, possible in laboratory conditions to coat a small article singly in many different ways, and to achieve some highly spectacular results, but from the practical and commercial viewpoint such treatments are of very evanescent interest. Obviously the whole criterion of the practical approach to vacuum metallisation is one of quantity production and, of course, the great factor overcoming many essential uses at present is the time required to exhaust down to the present operating pressures. Again, the customer looks upon the process as being a cheap process, but although he is in many cases paying anything up to 50 per cent. of the cost of treatment by orthodox plating or silvering techniques, there is a tendency to expect similar results both in appearance and in protective value.

Satisfactory Jigs

Another expensive and difficult part of the technique on a quantity production scale is to jig the articles satisfactorily. After all, the discharge takes place from the metal wire in a straight line, and the discharge is complete in some period like 4 sec. During this period it is essential that every part of the contour of the article is at some time exposed to this direct line transmission. This leads to a relatively costly and complex jig arrangement which turns the articles into the direct line at some period in the 4 seconds' interval. Where there is a guaranteed continuity of flow of production, then it is possible to spend reasonable sums of money on jigging, but if the operator is faced with a variety of different articles, then the jigging problem does undoubtedly present quite a considerable engineering task.

Of course, some extraordinarily useful results have been achieved, for example, one part of a door handle had previously been made as a zinc-based alloy die casting, which had been nickel and chromium plated by orthodox methods. Due to the shortage of nickel, a successful attempt was made to replace the zinc alloy die casting by a plastic moulding which has been satisfactorily aluminised by the vacuum technique. The result is just as satisfactory to the manufacturer, and the ultimate cost of the article has been cut by 50 per cent. Here there is a considerable flow, and even when nickel becomes available again it is doubtful whether this particular application will revert to a die casting. For small brooch frames, jewellery, bottle tops and the like, the output has been great enough to warrant the use of the vacuum technique as a competitive trade process. Satisfactory results have been achieved on glass—many novelty articles in plastic have been coated by the process to give novelty appeal at prices which could not possibly be achieved by any other method. In short, the process of vacuum evaporation is another tool in the hands of the metal finisher and will suffer, of course, if demands are made to use it in circumstances where it is not practicable commercially.

American Results

Again, on the industrial side where thin metal coatings are required for conductivity, the expense is relatively unimportant because it is possible to carry out the process to complete a job which cannot be done easily by any other means. For example, the tin coating of glass, to give a transparent yet electrical conducting coating to a glass surface, offers tremendous possibilities as a means of preventing the glass in trains, omnibuses and motor-cars from steaming up. The results in America, although somewhat glamorously presented, do not suggest that the technique is any further developed in the States than in Britain, but they have in America a tremendous advantage in the sense that their volume of production of a specified article is so much greater, which in turn means that more expense can be undertaken on the jigging technique.

From Germany the following report has been received: "This new technique of metal plating in a high vacuum, whose initial difficulties may be looked upon as having been overcome, is an extremely effective means of giving a metallic appearance to

crystal-clear plastics, from which mass-produced articles can be made rationally by injection moulding. Surprising effects can be achieved in this way. Polystyrene, acryl resins, polyethylene, and even cellulose acetate, can be injection moulded into parts which have a very hard and glossy surface. When metals are deposited by evaporation, the resulting coating is extremely thin and it reproduces the gloss as well as the structure of the surface on which it has been deposited very well. Coatings of this type are ordinarily 100 to 1,000 times thinner than the platings obtained by electroplating, and even gold or other noble metals can therefore be used for this 'jewellery of the plastics' as it is called, even in the case of mass-produced articles. And so we find insignias, maker's name-plates, radio cabinet parts, ornamental fittings, handles, knobs, mouldings, rosettes, jewellery and many other parts made by this new process being eagerly taken up by the consumers.

"All these new things will be included among the numerous attractions to be offered by the first large post-war exhibition of the German plastics industry, the production exhibition and technical fair 'Plastics, 1952,' which will be held in Dusseldorf from 11th to 19th October."

Once again, then, an attempt to "gild the lily!"

The above represents practical conclusions based upon the opinions of operators of the process. There is no doubt that it is a most useful and fascinating approach to finishing, but there are certain difficulties to be overcome by the potential user, and as long as it is realised that investigation must proceed towards the end of the solution of these difficulties, then considerable progress can be expected. But to promise the earth—now!—will kill the potentialities of the process.

The above notes are prepared with acknowledgment to the Directors of A.E.R. (1938) Ltd., 196 Great Cambridge Road, Enfield, who are associated with Dohm Ltd., Victoria Street, London, S.W.1.

INSTITUTE OF METAL FINISHING

A JOINT meeting of the Corrosion Group of the Society of Chemical Industry and the Institute of Metal Finishing (London Centre) will be held at Northampton Polytechnic, St. John Street, London, E.C.1, on Monday, 20th October, 1952, at 6.0 p.m. The following papers will be presented: "Tin-Nickel alloy and Nickel-Chromium coatings: some comparative tests," by S. C. Britton, M.A., and R. M. Angles, L.I.M.; "Tin-Nickel Alloy coatings: methods of testing thickness and porosity," by S. C. Britton, M.A., and D. G. Michael, B.Sc.

JOHN HAWLEY & CO. (WALSALL) LTD.

IT has recently been announced that John Hawley and Co. (Walsall) Ltd., Goodall Works, Bloxwich Road, Walsall, Staffs, has been converted to a public company. The share capital will now be £100,000 in 100,000 6 per cent. cumulative preference shares of £1, of which £70,000 have been issued and fully paid up, and £100,000 of 2 million ordinary shares of 1s. each, of which £70,000 have been issued and fully paid up. The directors of the company are as follows: Horace Sidney Hawley, Kelver House, 39 Broadway, Walsall (chairman and joint managing director), manufacturer; John William Hawley, "Dolanog", Pwllycrochan Avenue, Colwyn Bay (advisory director), manufacturer; Norman Arthur Hawley, "Sanford", 15 Jesson Road, Walsall (joint managing director), manufacturer; Frances May Hawley, "Rae Hills", Meliden Road, Prestatyn, spinster; Sidney James Hawley, 191 Broadway North, Walsall, manufacturer.

TWO NEW SHELL SOLVENTS

TWO new Isopropyl solvents are now being offered by Shell Chemicals Ltd. Known as Shell I.P.S. 1 and Shell I.P.S. 2, they are being marketed at a purity specification of 99 per cent. I.P.A. by weight and 85 per cent. I.P.A. by weight respectively. Supplied in tanker wagons or drums, the products can be used in a variety of outlets including surface coating, lacquer, plastics, leathercloth, printing, as well as for many other solvent purposes.

Further information can be obtained from Shell Chemicals Ltd., Norman House, 105-109 Strand, London, W.C.2.

THE MAN ON THE JOB

by **"SERVICE MAN"**

FASHIONS in paint finishes and colours come and go, like anything else, according to public demand. There seems to be no concrete reason for these changes and attempts to educate the public into being colour-conscious seem to have little or no effect.

Wrinkle finishes have had a longer innings than most and polychromatics have much appeal, judging by the demand. The multi-coloured industrial finishes have had their day and so it goes on. Personal choice is wide and varied in some things and favours monotony in others. I will have much to say about the latter item later. Geographical location appears to influence the use of colour. In my travels I have noticed that a colour scheme, say light oak graining, is common to a whole village. Farther on we may come to cream and green; black and white; or ivory and red schemes in various townships, within an hour's run. Evidently someone leads and all the others follow.

Popularity Poll

Something of the sort exists within the homes, but not until I did a special survey on this did I realise how opinions differ on colour.

At the time we were supplying polychromatics for the finishing of a world-famous patent ash-tray. The subject of alternative finishes inevitably came up, and we were asked to submit a range of twenty-four different finishes. The only stipulation being that the paint had to pass the heat test in the same way as the polychromatics, otherwise imagination could run riot.

When the twenty-four ash-trays were ready I took a poll of the order of popularity, just from sheer curiosity. Twenty people made their selections, and these were noted. This list and the ash-trays were taken along to the makers, who were in a different part of the country. A director, the sales-manager and the works-manager each made a selection, which was also noted. I then asked if half-a-dozen of their employees, three male and three female, could also make a choice. The completed list of twenty nine selections was then passed over to the director, and as you may have guessed, there was nothing unanimous or decisive in the order of popularity. I might add that my own pet selection was well down in the batting order.

The sales-manager was particularly keen to find out the reason for each individual's choice. This was done with those available and we received as many answers. However, sorting it all out, it appeared that the women had chosen with the idea of blending colours and effects with their own home furnishing schemes, etc. The men, curiously enough, had chosen the brighter colours as a direct contrast—they wanted the ash-tray to "stick out" so that it could be easily found when wanted. The other paint man and myself had selected as a result of the work put into the trick finishes. However, six of the new types were put into production for a trial period until the sales reaction was obtained. About a year later I met the sales-manager and asked him if he had any data on the public's choice. He informed me that the polychromatics still led the field. It appears that this finish is apparently neutral, regardless of shade, and, like bronze finishes, will fit in anywhere.

Monotony in Colour

This brings me to the point, mentioned earlier, about monotony in colour. We are all entitled to say what we think, and this is as good an opportunity as any for me to get my little grumbles off my chest. Maybe someone will take up the argument, and that is the object. We leave too many things to the decisions of others, and have only ourselves to blame for being led by the nose.

Domestic kitchen equipment, bathroom cabinets, etc., are generally finished in anything from white to

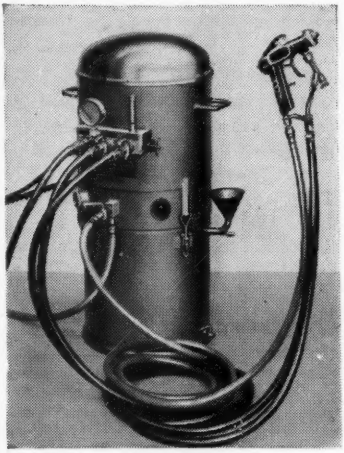
cream. Now and again someone plumps for eau-de-nil or a combination of both. Bronze seems to be the usual finish of heating appliances. Cameras, typewriters and instruments are mostly done in black or grey wrinkle. These are a few things on which to start the discussion. In my opinion, standardisation, or typing, appears to have set in. I do not think that this has anything to do with the present economical position at all; and as a citizen I deplore this trend towards monotony in colour finishes for similar appliances. With a wide range of colour from which to choose, what do we see? Everyone apeing the other but just keeping that fraction away so as not to be accused of copying.

Now then, "let battle commence"! What's the matter with a pink refrigerator; a pastel-blue washing machine; a buttercup-yellow kitchen unit; a peach-coloured water-heater, etc., all set in less stereotyped surroundings? Of course, I know very well why we do not have such things; the general public hates making changes, and those concerned with the making and finishing of these and similar articles are afraid to experiment. Are they afraid or are they too set in the groove? Why not let the new generation have a go at brightening things up as a change?

Standard Shades

I was discussing these points with a customer, and had about reached this point when he proceeded to floor me by saying that the paint industry advocated the use of standard shades. Now this is where the meaning of a word can be wrongly interpreted. We do advocate the use of standard shades—but not a colour scheme for similar appliances. This is where I unload another grumble for myself, and the paint manufacturer in general. By standard shades the paint manufacturer means exactly what the word stands for—a fixed degree of colour in this case. Let me give you some inside information on this, you may get quite a shock.

During a recent check on two colours, battleship grey and cream (the customer's titles, by the way) we found that we were supplying thirty-one shades of the grey and twenty-three of the cream; each one a little different in shade from the other, and all in gloss finish. We are not concerned with the



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matt, egg-shell or semi-gloss types at all —just the glossy stoving finishes. In an attempt to shorten the list we asked several customers to accept a standard shade. The response was negative; each one wanted his own little personal choice. The general answer was, "we have always used it, our customers know it."

Allow me to put my head into the lion's mouth once more when I say that it would not make an atom of difference to the general public if the users of the twenty-three degrees of cream (some call it ivory) all used one standard shade —it would still be cream, or ivory. What's in a name? That is the paint man's interpretation of the word "standard."

This leaves the way open for a reply from the makers of domestic appliances. Can they explain why all this equipment be confined, in finish, to such a narrow range of colour? The stock answer that it will fit in anywhere is not good enough. Do you plan only one "shade" of colour in the garden, so as to "fit in" with the grass and trees? Does anyone shudder at the sight of blue, red and green in various shades and tints in the flower beds? Let us digress for a moment whilst those interested think out the reply; we will come back to it in a few moments.

In Place of Black

In my early youth I was the proud possessor of an Elswick bicycle. It was coloured—Elswick Green—and was, as far as I know, the only coloured bicycle on the market challenging the universal black. My bicycle was an object of curiosity. The older readers may remember a book published about forty years ago, called "The Mystery of the Green Bicycle," or words to that effect. Assuming my timing is more or less correct, what has happened in the bicycle industry during the last forty years? Look at them today—all colours, the brighter the better; yet still some prefer the black. Anyway, these brilliant-coloured machines hardly raise a comment and fit in with the surroundings just the same.

Henry Ford was alleged to have said, some time or other, that his customers could have a car any colour they wished as long as it was black. That was in the days of the "Lizzie." Today the motor-car industry makes the roads brighter and comparatively safer by using an almost unlimited range of colour in their finishes. (In fact, black cars represent less than one-third of the popular car output.—ED.)

Perambulators, push-chairs, etc., are no longer universally black, and there are many other everyday things to be seen where the monotonous standard black has been replaced simply because a pioneer had vision.

The aforementioned articles were once all black, but now we have an infinite variety of colours from which to choose; there is no movement towards similar finishes for similar articles as there is in the case of domestic appliances. They are not the only culprits, so let me see how far down the lion's mouth I can get before my head comes off.

If camera and photographic apparatus in general must have a non-reflective finish, why must it be a black or grey wrinkle? Is there anything against using clean, bright colours, even if hanging on like grim death to the wrinkle? I know all about the matter of non-reflection being a "must" for the interiors, but what about a red or green, or any colour for that matter, on the outside. Would the camera be carelessly handled if it was not a respectable, subdued, refined, reverential black?

You typewriter people. The same remarks and questions apply to you. Is there, or is there not, a definite reason for it, or is the answer to be the one so often offered, "Black doesn't show the dirt"? That will not do, either; black does show the dust and dirt, and I suggest to you that a wrinkle finish contributes to this.

Twenty-three Degrees of Cream

Let us go back to the start of all this. Must refrigerators and those domestic appliances previously mentioned be kept within the white to cream boundary? What say you makers of these things? Let the general public have some "gen" on the matter. In the meantime how about that little matter of twenty-three degrees of cream? Who or what decides whether a shade of cream should be called ivory, pale cream or "anything-you-like-cream"; if it is too pale; too deep; too yellow; too red, and so on? Lastly, and this is very important to the paint manufacturer everywhere, why the little differ-

ence from a competitor's product. Mass-production reduces costs and selling prices in paint manufacture as in anything else. If you all want to stick to the cream shade there is an incentive for you. I, as an individual, hope you will disagree. In my own case, a pink washing machine would look far cleaner and warmer than the off-white (should be white) one that I now have.

As a parting shot, let me say that never, in my years of travelling around, visiting showrooms, exhibitions and so forth, never have I seen a prospective buyer of any of the articles mentioned choose one particular make because of its colour. How, then, do you account for those twenty-three shades I have been getting at you to sort out?

Application and Stoving Methods

To get back to minding my own official business. The mention of degree of colour brings up the application and stoving methods. Let us take the case of a spray-shop using half-a-dozen or so pastel shades, which generally means a two-coat job. There appears to be a popular fallacy that a matt or flat grey undercoat or primer is the thing to use. Grey undercoats are very little cheaper than a white or tinted one, and the price of the grey being slightly less, may cost you more in finishing the job. To get an opaque finish in one coat of white or pastel-shade over a grey undercoat is impossible. The job may look all right and be good enough until it is compared with the same product over a white or tinted undercoat. In any case the amount saved on the price of a grey undercoat is offset by the extra amount of finishing used in obliteration.

Looking at it in another way. If you were doing a little job of painting at home—window-sashes, for example—would you use a grey undercoat for a white enamel? There is no magic in a spray-gun. It is only an air-brush; the advantage, in one way, is that the gun puts it on and leaves it at that. Playing about with a brush gradually thins the coat on the very places where you want the paint. Remember that little item about the "hedges"? Using a heavy coat to achieve obliteration can only add to your troubles. Rivelling, runs, boiling, etc., are all to be had for the asking by flooding surfaces in the hope of getting a solid colour coat. The correct way is so much easier for everybody.

Stoving Faults

Irregular stoving times and temperatures, badly designed, old or "home-made" ovens, all contribute to the variation in shade, gloss and general finish. Once again may I mention the necessity for keeping to the specified stoving schedule.

A common fault is the false economy of trying to save heat by shutting down oven dampers. Poor ventilation will give rise to many troubles. Frosting, sometimes called "gas-checking," is a result of this, and it can occur in other than gas-fired ovens. Good air circulation is a "must," and that is why stoving by forced-air-circulation type ovens produces a much better job than the box or static type. By the way, frosting can occur from the presence of a trichlorethylene tank in close proximity to the oven, where the "trike" vapour may be drawn in by the intake. "Trike" should be kept as far away from the oven as possible; in another room for preference.

Should anyone be curious to see the effects on synthetics or H.T. blacks, leave a vessel containing some "Trike" liquid by the oven intake and await results. You will get some beautiful frosted effects, also rainbow colouring on the black, but you will never get the same results twice, so it is useless as a commercial proposition. Besides this, I should warn anyone, when trying this, not to put their heads into the oven or smoke near the "Trike"; the effects are harmful and unpleasant. In any case, smoking in the finishing shop is to court disaster. Apart from the risk of fire, a little bit of cigarette ash goes a long, long way.

A clean shop, with careful handling of materials and no short cuts, are the main things to observe. It makes for quality finishing and trouble-free production, with a minimum of rejects, which may affect your pay-packet. It also keeps the trouble-shooter away from your door.

Inspection

Helping the customer is a pleasant task, providing the customer is co-operative. Investigating paint failure is apt to be somewhat unpleasant when it is obvious that someone has been

trying to "put one over." On the other hand, the paint is not always what it should be, in spite of rigid inspection. Any paint chemist will tell you that anything can happen in the can.

Although all paint manufacturers have some system of inspection, as a matter of interest I am going to outline our own methods, which are, after all, representative of the trade as a whole. This will give you some idea of what happens before the paint leaves the factory.

I do not intend to describe test methods in detail, but paint is tested as nearly as possible to the way in which it will be used. It is also tested on its performance, from batch to batch, under a fixed set of conditions. This may consist of a certain weight of paint spread over a given area; dried at a constant humidity; air temperature and rate of air-flow in respect of air-drying materials. An equivalent type of procedure applies to the stoving types.

From each batch a "check" sample of about half-a-pint is filed away for one year, by which time it is estimated that the paint will have been used. Records of performance during the tests are made and are on file for reference. Any complaint regarding a batch is referred to the Inspection Department, who can examine the check-sample, and they will either verify or dispute the claim. If the issue is in dispute the trouble-shooter goes out armed with this information, and usually finds the answer. Should this not happen, a sample of the bulk supply is obtained, plus some of the articles on which the paint is to be used, and further tests are made on a wider scale.

A Specific Complaint

Very few people realise the amount of apparatus available for the testing and examination of paint in its liquid state or as a dried film. For the benefit of the odd few who may try to "put one over," and for others who may be interested, here is a typical illustration of the resources at the command of the trouble-shooter.

A paint system of three coats was devised for use on aluminium and supplied to a firm who serviced and renovated a fleet of vans. A complaint arrived saying that the paint was peeling and cracking on some of the vans, and a repaint bill was involved which we would be expected to meet. Tests on the check samples were made, and these disputed the claim. The premises were visited and samples of the flakes and the paint were brought away. According to the renovators the vans had been painted exactly to specification, and nothing had been added or deducted. A side-by-side test of the returned paint and the check-samples agreed. While this was going on, several of the flakes off the peeled sections were examined, micro-photographed, and film-thickness was measured. The photographs showed up to eight coats in some parts, and indicated the causes of breakdown, together with quite an amount of aluminium oxide on the back of the paint film. A magnified view of the edge of paint flake can tell quite a story. It was therefore clear that the renovators' men had not done their work properly. Copies of the photographs, together with an explanatory letter were sent, in which the renovators were invited to submit similar flakes to the Public Analyst for his examination. Needless to say, the matter ended there.

In the matter of faulty supplies from one cause or another, reference to the "check" quickly verifies the fact and steps to remedy the trouble are undertaken.

"Tailor-made" Paint

Most paint failures arise from the fact that the paint is used for the wrong purposes or under peculiar conditions. It is always advisable to ask for paint that is suitable for the job in mind and not use one type for everything, or expect it to do everything. Do not be like the man who, convinced that the only paint worth using was white lead, painted his premises, which were within a stone's throw of a gas works, and wondered why the paint had gone "off-shade" after the sulphur-laden atmosphere had been to work.

With industrial finishes it is vitally important to state the purpose for which the paint is required. You cannot have your paint glass-hard, flexible, acid-proof, waterproof, heat-proof and any other proof, all in the one can. Ask for the paint for the job and, provided it can be done, you can have it "tailor-made" to suit your purpose.

If it should cost you a bob or two more than you expected to pay, do not worry about that; it is the money spent putting it on that counts. Putting on

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the right paint and being trouble-free is the most economical way to do business.

Fillers and Stoppers

The mis-use of fillers and stoppers have been contributory to many breakdowns. In the case of rough, heavy castings that have to be brought up to a good finish, the paint supplier usually specifies a process which comprises the minimum number of coats. If the user wants to apply an extra coat or two, so much the better. It is when a coat or two is left out that the risk of breakdown may be expected, and afterwards have far-reaching consequences.

I can quote as an example of this the part history of three marine Diesel engines exported to South America.

The makers' agent over there reported on the condition of the engines on arrival, and also sent a copy of the findings made by the shipping company's insurance people. The paint had broken down and the engines were in a very rusty condition. These would cost quite a bit to repaint, and the question was who was going to foot the bill.

The makers, having used this paint system for several years, told us that the three engines were part of an order of twenty-four, twelve of which had already been received in excellent condition. Flakes of the paint were requested by air-mail and went through the tests previously described. At the request of the makers, I spent several days in the factory from which the faulty jobs had been sent.

During the time I noticed that during rush periods some castings that had previously been machined were hastily wiped over with some very dirty spirit and "blown dry," using an air-line which spouted a fair amount of water. Filler and knife stopper were then applied, missing out the primer coat, and, after wet sanding, were blown dry in the same manner. A "sharp" coat of overthinned paint was slapped on, and before closing down for the day a "finishing coat" was applied. Early the next morning the castings were packed into a crate and were ready for dispatch.

Examination of the flakes had shown

rust behind the filler-coat; no primer and poor film thickness, about half of what it should have been. The water from the air-line and wet sanding, plus the badly-cleaned casting, had started something that the climatic conditions *en route* had accelerated.

The Lesson

There is a lesson to be learned, and things to keep in mind when handling a job of this sort.

(i) Heavy castings that have been machined take a lot of degreasing with the solvent-rag method, which is a doubtful starter in any case.
(ii) Most air-lines, when used "full bore," will send out water, visible or not.
(iii) Handling marks are generally invisible, and the damage is already there before starting the job.
(iv) Paint can be surface dry owing to warm atmosphere, but heavy castings remain cold and will stop "through" drying if not allowed reasonable time.
(v) Filling and stopping should not be attempted in depth in one operation as this may "blow" under heat.

It is never advisable to hurry jobs of this kind. Filling processes require time to harden off before wet or dry sanding. Fillers, being of a porous nature for ease of rubbing down, will hold moisture for a long time and if quickly coated over the moisture will be trapped. But, mark my words, that moisture will work its way out eventually.

Building up to a finish on big jobs, such as marine engines, parts of which receive a lot of oil in the machining, is not an easy job. Those unfortunate people who are held responsible for the finish are at the mercy of the chaps under them who can skimp or sabotage the job unless under strict supervision the whole time.

In conclusion, I am pleased to say that things go fairly smoothly. We trouble-shooters, or service blokes, call us what you will, get on very well with the customers. If anyone is in doubt about a method of processing, or in need of advice on layout or equipment, our services are at your disposal for the asking, and what is more, free of charge. If we can assist you in any way in the finishing of your products we will be only too pleased to help. We are employed for that definite purpose.

ENAMELLING AND STOVING OVENS

HEAT AND AIR SYSTEMS LTD., Coastal Chambers, 172 Buckingham Palace Road, London, S.W.1, have prepared a leaflet dealing with enamelling and stoving ovens, which include the "camel-back," "straight-through" and "tunnel" types.

The former is a self-contained unit, complete with conveyor and paint-dipping tanks, whilst the latter is most frequently used for drying sprayed work. The "A" type oven, with flight-bar conveyor, offers an efficient form of continuous convection stoving oven. There is an illustration of this latter type stoving switchbox housings, fitted with the company's direct gas-fired air heater, incorporating flame failure control devices. The operation of the latter is shown diagrammatically.

THE CORROSION OF STEEL

A MEETING organised by The Iron and Steel Institute in conjunction with the British Iron and Steel Research Association, to discuss papers on the corrosion of steel under phosphate coatings and protective finishes, will be held at the offices of The Iron and Steel Institute, 4 Grosvenor Gardens, London, S.W.1., on Tuesday, 28th October, 1952, commencing at 2.0 p.m.; Mr. H. T. Shirley, Chairman of the Corrosion Committee of B.I.S.R.A., will be in the chair.

The meeting will be open to all interested in the matters under discussion. There will be no charge for admission, but tickets will be required, and these can be obtained from the Secretary of the Iron and Steel Institute.

THE OIL AND COLOUR CHEMISTS' ASSOCIATION

THE following titles are of papers appearing in the Journal of the Oil and Colour Chemists' Association, September, 1952: "The Statistical Treatment of Experimental Data," by A. Lord, B.A.; "Some Examples of the Statistical Approach to the Planning and Interpretation of Industrial Experiments," by B. Saunders, B.Sc., A.R.C.S., A.R.I.C.; "Oil Absorption Tests for Pigments," by J. R. Bainbridge.

GAS CARBURISING

CARBURISATION is a metallurgical process in which a hard "case" is imparted to the surface of steel by heating the components in a gas-tight retort placed in a heat-treatment furnace to a certain predetermined temperature.

Carburisation may be carried out by using solid, liquid or gaseous media, and although the means probably most widely employed is that of using solid carburisers, the undoubted advantages which accrue from gas carburising have resulted in that method coming rapidly to the fore, particularly where large components requiring relatively deep cases have to be treated and precise control of case is essential.

Where "natural gas" is not available, carburising atmospheres are normally of the high hydro-carbon type suitably diluted. Typical examples are butane or propane diluted with charcoal burner gas, raw town's gas or burnt town's gas. Such hydrocarbons possess the characteristic of "cracking" on the steel surfaces at temperature, and give rise to carbon deposition which takes the form of a hard adherent scale. The results of such deposition are inevitably the slowing of the carburising rate and the bad fouling of retorts. In such circumstances, it is not possible to carry out carburising under precisely-controlled conditions, for the "stopping off" effect of the deposit may vary and unless precise control is available, the full benefits of gas carburising cannot be utilised.

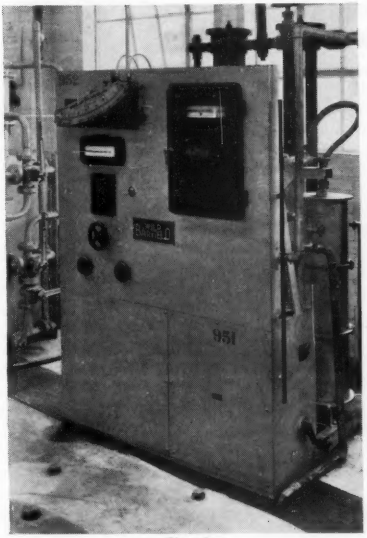


Fig. 1
Gas preparation unit

One process depends upon using raw town's gas which is processed by passing the gas through a catalyst, filters and dryers, so that the organic sulphur compounds are removed. The action of the catalyst employed in this particular process may be seen from the following typical analyses (shown below) of town's gas before and after passing through the catalyst.

It will be seen that the methane content is only slightly reduced and there is a considerable increase in the amount of carbon monoxide. Town's gas supplies vary according to the method of production but if the methane content is low, the carbon monoxide content invariably is correspondingly high.

Treatment of Town's Gas. Town's gas received direct from the mains is fed through a flow meter and compressor to a special catalyst—the action of which is shown in the following table.

	Raw Town's gas per cent.	Prepared Town's gas per cent.
Carbon dioxide ...	3·3	—
Oxygen	0·6	—
Unsaturated hydro-carbons ...	2·1	0·6
Carbon monoxide ...	16·4	20·2
Methane	24·0	23·6
Hydrogen	49·5	51·2
Nitrogen (balance) ...	4·1	4·4
	100·0	100·0

Vertical furnaces sink into pits. Those on the right are for secondary hardening

From the catalyst exit the gas passes through the air cooler to silica gel dryers, of which only one is used at a time so that the plant can be operated continuously. Following passage through the dryer the gas goes via an inferential meter on to the retorts for the process of carburising.

In operation the carburising retort is purged and lowered into a furnace controlled at the specified carburising temperature, and after adjusting the gas flow reading on the flow meter no further attention is required until the "active" carburising period is finished. The compressor is then stopped and the outlet valve of the retort closed. The preparation unit —shown in Fig. 1—can then be used to purge other retorts while the first charge is completing the diffusion period.

Regeneration of the silica gel is quite simply effected by a low temperature treatment in a small forced air circulation furnace. Both catalyst and dryers are regenerated after a certain volume of gas has passed through them for purification, the total volume being read off the inferential meter. Whilst the frequency of regeneration is dependent upon the volume of gas passed, this normally does not exceed once per week even when the plant is in use for 24 hours a day. In any case, regeneration of the catalyst can be conveniently carried out while a charge is being diffused and the preparation unit is not required; as two dryers are provided the continuous use of the plant is possible.

Standard equipment is obtainable for gas flows up to 200 c. ft./hr.

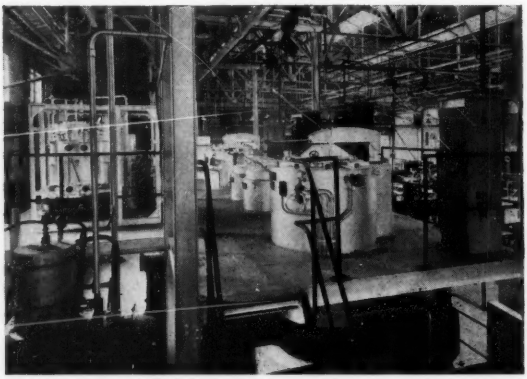


Fig. 3
Hardening installation surrounded by staging—in contrast to those in Fig. 2

(5·66 M³/hr.) which will cope with charges up to 15 cwt. (762 kg.) held in a retort having available a uniform temperature of the order of 2 ft. 3 in. dia. by 4 ft. 6 in. (1·37M) deep.

General Advantages

The equipment fed with raw town's gas direct from the mains prepares the gas for carburising without any additions such as butane, propane, etc., whilst all the deleterious constituents of the town's gas are removed.

A precise control of the depth and type of case is afforded, allowing the surface of a component to be ground without appreciable decrease in carbon content or the loss of hardness. Furthermore, the control of the carbon gradient ensures that too high a carbon content is avoided at the surface of a component which can thus be ground without danger of cracking. A greater proportion of the total case is hardenable and the hardness transition from case to core is more gradual.

Prepared town's gas does not leave a hard carbon deposit upon the work with subsequent "stopping-off" effect, any slight deposit from prepared town's gas being in the form of pulvurent graphite which has no "stopping-off" effect. There is, therefore, no necessity to achieve any balance of mixture to minimise deleterious sooting, and carburising can proceed at the correct temperature for the steel under treatment. An additional factor is that with precise control over diffusion, "active" carburising can be undertaken at the maximum theoretical rate.

The following comparison is given only as a guide to the speed at which gas carburisation can be carried out as against other methods. The work, mild steel of Specification En 32, was treated at a temperature of 900° C. to give a case depth of ·040 in.

Solid carburising media (pack method)	...	6·6 hr.
Liquid carburising media (salt bath)	...	4·8 hr.
Gas carburising media (prepared town's gas)	...	4·0 hr.

From these figures it will be seen that gas carburising is much quicker than other methods, and this effect is, of course, emphasised for greater case depths.

The fact that town's gas is used without any additions materially lessens the cost of the carburising atmosphere, and as the bulk of the cost of carburising is attributable to the heating time the shorter time of treatment referred to in the previous paragraph must also materially lessen the overall cost. Furthermore, when compared with box carburising, a saving is effected in the labour costs involved in packing, unpacking and handling boxes, and in the amount spent on carburising media, its storage and removal.

The gas preparation unit of the equipment has very few controls, and one of its special features is that once relevant valve settings have been made, the complete gas carburising process may proceed without supervision apart from stopping a compressor and closing the retort valves when the "active" period ends and diffusion begins. Actual control may safely be left to ordinary hardening shop personnel.

An installation occupies little space when compared with that taken up by the number of furnaces required to give an equivalent output by pack carburising methods. This is of prime importance when existing space has to be used for an installation.

For the information and illustrations in this article acknowledgment is made to Wild-Barfield Electric Furnaces Ltd., Elecfurn Works, Watford By-pass, Watford, Herts.

OIL & COLOUR CHEMISTS' ASSOCIATION

Hull Section

Meetings of the Hull Section during October are as follows:

13*th October*.—Paper by B. Cyriax; "Synthetic Latices and their Application in the Paint Field."

17*th October*.—Annual Dinner Dance to be held in the New York Ballroom, Hull. Tickets are obtainable from: T. A. Fillingham, Esq., c/o John M. Hamilton and Co. Ltd., Sculcoates, Hull.

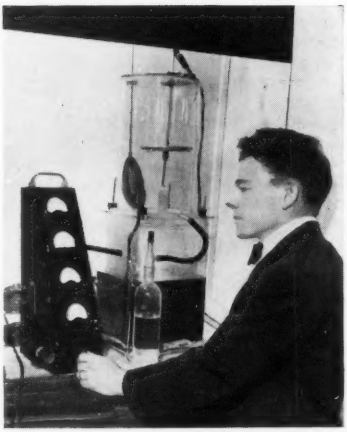
London Section

15th October.—Paper by R. N. Wheeler, B.A. (Cantab.), A.R.I.C.; "Epoxide Resins."

NEW ALUMINIUM-PLATING PROCESS

A PRACTICAL process for electrodepositing aluminium at room temperature has recently been developed by D. E. Couch and Abner Brenner of the U.S. National Bureau of Standards. Dense, ductile deposits of the metal are being obtained at the Bureau from a new type of organic plating bath consisting of an ether solution of aluminium chloride and a metal hydride. The new bath is expected to find important application for electroforming articles with close inside tolerances, such as waveguides, and for providing various types of equipment with a thin protective coating of aluminium.

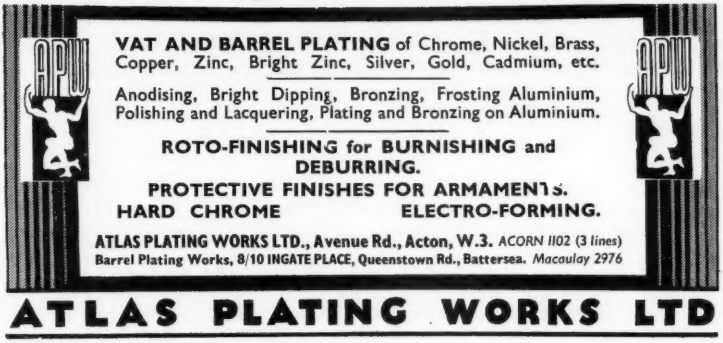
Because aluminium is so far above hydrogen in the electromotive series of the elements, it has never been deposited from aqueous solutions, which always contain some hydrogen in ionised form. Aluminium is usually produced commercially from a bath of fused cryolite and aluminium oxide. However, this process must be carried out at a high temperature, and the metal is obtained in a fused state, unsuitable for electroplating or electroforming. Electrodeposition from non-aqueous solutions has been tried in the past, with some success, but the procedure was too difficult for practical applications, and the deposits were lacking in purity, ductility, and other desirable qualities.



Organic plating bath recently developed for electrodepositing aluminium at room temperature

Extensive research is now taking place in an effort to develop methods for depositing in good physical form

Objects electroformed of aluminium by means of the new hydride plating bath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unusual metals such as molybdenum, tungsten, titanium, and zirconium. Both fused salts and baths of organic solvents are being investigated. One of the first metals studied was aluminium. The success of the aluminium plating bath, developed in the course of this work, may be expected to give added impetus to the current widespread efforts to obtain other metals in pure form from non-aqueous solutions.

The aluminium plating bath is prepared at the Bureau by adding either lithium hydride or lithium aluminium hydride to an ethyl ether solution of anhydrous aluminium chloride. For best results, the ether should be anhydrous and alcohol-free. The concentration of the aluminium chloride is not critical and may vary from 1 to 4 molar. Current densities may be as high as 4 or 5 amp./dm.^{2} However, if thick deposits are desired, the current density should not be greater than 2 amp./dm.^{2} Because of the high concentration of aluminium chloride in the ether, the bath is not as flammable as would be expected.

To prevent the entrance of moisture, the bath is prepared and used in a closed container consisting of a glass plating vessel with a tightly fixed polythylene lid. Anodes of aluminium rod pass through the lid, and the objects to be plated (cathodes) are introduced and removed through a central hole which is ordinarily kept closed with a rubber stopper. If hermetically sealed, the bath will keep for several weeks; however, under ordinary operating conditions the solution slowly deteriorates and eventually gives streaked and brittle deposits.

No agitation of the bath is necessary. In fact, a quiescent bath is actually an advantage as the sediment from the anodes settles to the bottom of the vessel, making bagging of the anodes and filtration of the solution unnecessary. The composition of the bath is easily controlled since the only constituent that changes appreciably in concentration during the plating process is the lithium hydride. Occasional additions of lithium hydride increase the life of the bath, but in time the lithium hydride becomes insoluble and the bath can no longer be used.

When sufficient lithium hydride is used, the deposits are white, matt and quite ductile; but if the lithium content is too low (less than 3 or 4 g/l), the deposits become hard, brittle, and grey. Still further reduction of the hydride content produces deposits that are dark and stressed and that often crack or peel from the cathode. Ordinarily deposits 0·01 in. or more thick are visibly crystalline, but this effect can be reduced somewhat by adding a small amount of β,β'-dichlorethyl ether. Pitting, which frequently occurs in aqueous baths, is practically non-existent in the ether bath.

Cathode and anode efficiencies for the process are approximately 100 per cent. Deposits 0·05 in. thick have been prepared at the Bureau and thicker deposits should be possible if the sharp edges of the cathode are shielded to prevent treeing.

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TRAINING THE PAINTER OF TO-MORROW

ON the 3rd and 4th May, 1952, a conference was organised on behalf of the Association of Painting Craft Teachers in Harrogate. The Conference programme included the following:

Training for Large-Scale Work

Chairman: Mr. E. Dobson, F.I.B.D., R.C.A. (Brussels), President, Association of Painting Craft Teachers.

Speaker: Mr. V. W. Hosp, President, Federation of Painting Contractors.

New Materials and Methods

Chairman: Mr. Lincoln Jenkins, A.T.D., A.R.B.S.A., Principal of the Harrogate School of Art.

Speakers: Mr. E. W. Plowman, B.Sc., A.R.C.S., D.I.C., Director, I.C.I. Paints Division. Mr. J. K. Barraclough, B.Sc., A.R.I.C., Lewis Berger (Great Britain) Ltd. Mr. R. E. Berry, I.C.I. Paints Division.

Painting as a Career

Chairman: Mr. J. E. Littler, F.R.S.A., F.I.B.D., President, Institute of British Decorators.

Speaker: Mr. Ellis Whatley, M.B.E., F.I.B.D., President, National Federation of Master Decorators.

How Employers and Manufacturers Can Help

Chairman: Mr. John Marsh, Director, Industrial Welfare Society (Incorporated).

Speaker: Mr. J. E. Deady, F.R.S.A., F.I.B.D., Immediate Past-President, Association of Painting Craft Teachers.

Speakers at the Conference Dinner were Mr. H. W. G. Bidgood, Joint Managing Director, I.C.I. Paints Division; Mr. R. Whittaker, F.I.B.D., Founder-member, Association of Painting Craft Teachers; Mr. Charles H. Eaton, F.R.S.A., F.I.B.D., a Founder-member and Secretary and Treasurer, Association of Painting Craft Teachers.

The lectures and discussion have now been published in book form, available from the Secretary, Mr. C. H. Eaton, F.R.S.A., Morden Cliff, 107 Morden Hill, London, S.E.13.

Birmingham Paint, Varnish and Lacquer Club.—The next meeting of the Club will be on the 6th November, and will consist of a Question Time, under the title "Raw Materials—Suppliers on Trial!"

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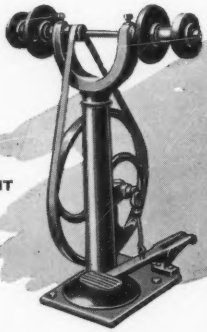

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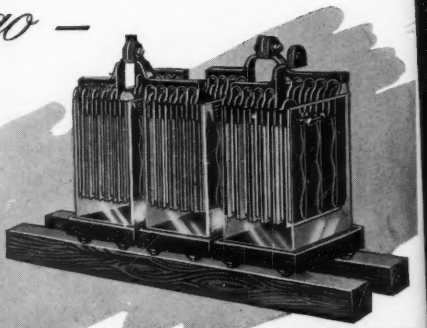

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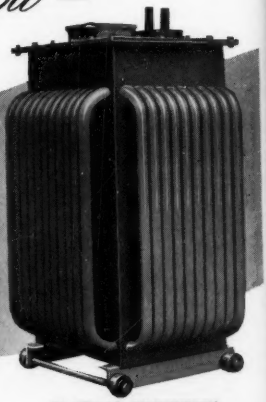

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